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Jussi Ilari Kantola
Salman Nazir
Vesa Salminen *Editors*

Advances in Human Factors, Business Management and Leadership

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Advances in Human Factors and Ergonomics 2020

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Proceedings of the AHFE 2020 Virtual Conference on Human Factors, Business Management and Society, and the International Conference on Management and Leadership, July 16–20, 2020, USA

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Preface

This book provides researchers and practitioners a forum to share research and best practices in the application of human factors in business management and leadership. Just as human factors have been applied to hardware, software, and the built environment, there is now a growing interest in the management practices and learning experiences. Principles of behavioral and cognitive science are extremely relevant to the design of instructional content and the effective application of technology to deliver the appropriate managerial and leadership experience. These principles and best practices are important in corporate, higher education, and military environments.

This book also aims to share and transfer not just knowledge, but share best leadership and management science practices that is of real value in practical terms—value that can help leaders ensure their organizations stay ahead of the competition through continued innovation, strong competitive advantage, and inspired leadership.

A total of thirteen sections are presented in this book. Each section contains research papers that have been reviewed by members of the International Editorial Board.

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Section 1 Business Management and Efficiency
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July 2020

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Barriers to the Development of Regional Competitiveness in the Context of Regional Economies - EU, Latvia, Region Vidzeme Case Study

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Abstract. Innovation potential and the creation of new knowledge, which is considered to be one of the main drivers of economic development, is particularly emphasized in region development [1–3]. However, in effect regions face significant barriers to the development of innovation and smart specialization. Despite strong institutional support impulses, the current contribution of regions to national competitiveness is debatable. As an example, the study analyses one of the regions of the EU Member State Latvia (Vidzeme), its contribution to national productivity and the main obstacles to the development of the region's innovations - smart specialization. The results obtained in the context of a single region inductively highlight the weaknesses of region economy concept and point to opportunities for its improvement.

Keywords: Region competitiveness · Smart specialization · Region development · Innovations · RIS3

1 Introduction

In the context of economic growth, region economy concept, based on the thesis that regions are the most appropriate level to cope with global competition [4, 5] and that region development is a prerequisite for economic growth and prosperity creation [6], continues to prevail. The revealing of region economies has flourished in recent decades [2, 7, 8]. Studying economic cycles, it has been found that innovations are the key to economic growth and a new economic cycle [9, 10]. But despite that, over the past years, investment in new projects has halved [11]. Complications in the national economy and in the financial sector have encouraged societies and public authorities to work together

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to find new ways to solve problems [12]. The competitiveness of regions is associated with an increasing emphasis on the growth of competitive advantages. Innovation potential and the creation of new knowledge, which is considered to be one of the main drivers of economic development, is particularly emphasized in the growth of regions [13, 14]. The concept of competitiveness is increasingly being extended to regional level. Previously, regional policy has sought to make regions more competitive by attracting internationally competitive companies, but these initiatives have had little success. The search for a new approach to regional development is now mainly focused on making local companies more competitive. This has led to regional "assets" as the source of region competitiveness. One of the most up-to-date and cutting-edge approaches to competitiveness stimulation is smart specialization, which is the transformation of economy into higher added-value, productivity and a more efficient use of resources. Scientific technology is increasingly becoming the major source of the creation of competitive and sustainable benefits for both countries and regions [14]. It should be admitted that the quality and quantity of innovations, created by entrepreneurs, is the key factor of the efficiency of scientific technology [15]. Including the opportunities offered by the modern technologies such as internet - it is less frequently used by the companies with small turnover [16].

The OECD also stresses the need for countries to become more competitive if they wish to maintain their economic position in relation to other industrialized or developing countries and to respond to challenges such as productivity growth, e-commerce and technologies [17]. Including involving young people in regional development - young people in entrepreneurship has been on the agenda of the European Union since the economic crisis [18, 19]. The OECD concept of competitiveness is being increasingly extended to regional level. According to the OECD, a competitive region is the one that can attract and retain successful companies and maintain or increase the standard of living of the population of the region. Skilled labour and investments are shifting from "uncompetitive" regions to the regions that are more competitive. Extending the concept of competitiveness to the regional level has a major impact on the directions of regional development [20]. Employees are one of the most important resources for the success of the company. Digitalization and change of the labour market are new circumstances for companies to face [21, 22]. One of the most up-to-date and cutting-edge approaches to competitiveness is smart specialization, which is the transformation of economy into higher added-value, productivity and a more efficient use of resources. Smart specialization is connected with competitive advantages (existing and potential) [23, 24].

The aim of the study is to promote an in-depth understanding of sustainable innovation ecosystem in the areas of smart specialization in the regions, in order to be able to efficiently increase innovation capacity outside the industrial centres of big cities. The object of the research is Vidzeme, one of the four regions of Latvia, a member state of the European Union.

Research methods used. The assessment of 127 regional experts from industrial, academic, civic and governmental environments from February 2019 to October 2019, selected within the Quadruple helix model approach, has been used in the study. In

scope of the study 21 in-depth expert interview, 2 expert interviews and 6 thematic discussions have been conducted. Secondary data have been derived from official national statistical databases. Quantitative and qualitative methods of secondary and primary data processing have been used.

2 Vidzeme Region Smart Specialization Area Development Assessment

One of the basic indicators of smart specialization and innovations is the value-added, created by the region. The European Commission has defined productivity as the output derived from each input unit [24]. Productivity can refer to capital productivity, labour productivity and resource productivity, depending on the investments considered, and thus productivity as a labour force has different dimensions [25]. Only 4% of Latvia's total added-value is generated in Vidzeme, with the total adjusted level of growth in Vidzeme being +3.5%, which is one-third slower than the country average (+4.8%) and twice slower than the one of the capital city (Pieriga) region (+7.5%) (CAGR 2014-2016). This is the second lowest figure in the country. In absolute figures, Vidzeme region generated a total turnover of EUR 1.778 billion in 2016, providing the country with EUR 488.7 million value-added. The increase in value-added per person productivity in Vidzeme is +2.2% (CAGR 2014-2016), reaching 12.7 EUR per employee in 2016. In Latvia, the total value-added increase per employee is +3.4%, which is about one-third higher than in Vidzeme. The value-added per employee is in Riga region (20.1 EUR) [26]. In terms of both value-added and labour productivity per employee, Vidzeme lags behind Latvia's average by one-third. In Vidzeme, manufacturing accounts for 41% of the value-added, generated by businesses, followed by trade (20%) and services (20%). Mining (+15.4%) and trade (+8.1%) have been the fastest growing sectors in terms of value-added growth [27]. Newly established companies in Vidzeme region have grown by 34% for the time period from 2014 to 2016, which means a positive trend compared to the period from 2007 to 2016. The number of newly established high-growth companies by number of employees[1] has also increased: +32% (CAGR 2014–2016). However, *the number of newly established high-growth companies* in terms of revenues has dropped: −16% (CAGR 2014–2016) [26, 27]. The mentioned indicators show an increased activity of newly established companies in Vidzeme with low revenues, which is the evidence of the willingness to establish companies and the lack of knowledge in ensuring their revenues, which is related to the company's ability to create and sell high value-added products. The results of the study indicate that Vidzeme's economy lacks a higher growth stimulus and that economic model has changed little and is still based on the advantages of low-cost competitiveness. In order to stimulate innovation growth in the regions, Latvian public administration has carried out support activities in the period from 2014 to 2020, assuming to increase the amount of attracted private investment in R&D in the regions, which includes several measures for the industrial sector (SAM

[1] CSB definition: A high-growth company is a company with an average annual growth rate of at least 20% per year over a three-year period, where growth can be measured both in terms of number of employees and revenues.

1.2.1): (1) Aid for the development of new products and technologies, (2) Aid for the improvement of technology transfer system, (3) Innovation vouchers for SMEs, (4) Aid for the introduction of new products into manufacturing. There are few support projects being implemented in Vidzeme region - only 5% of the total number approved in Latvia [27, 28]. The innovation support is being used the most actively by the entrepreneurs in Riga region, industrial area of the capital city, while the lowest activity in private sector investments in R&D area is observed in Vidzeme region. As a result, not only are Vidzeme organizations currently generating one of the lowest value-added in the country, they are also relatively less involved in smart specialization support measures, which indicates the continuation of the trend of the region's lower growth compared to the capital's industrial area [29].

3 The Assessment of the Region's Smart Specialization Support Mechanisms

In order to evaluate in details the factors influencing the development of smart specialization, revealed in the research, and to identify the main barriers, a unique and specialized survey of entrepreneurs, management, academic and civic environment experts of Vidzeme planning region has been made and 5 thematic expert discussions have been conducted. A total of 127 executives and key professionals have been included in the expert panel within a 9-month-long period. Two main impact groups have been distinguished: (1) Assessment of current level of information on the available smart specialization support measures in Vidzeme region, (2) Assessment of the significance of support offered and provided by Latvian and EU governance institutions for smart specialization development and growth in the region. The assessment of the level of information in the field of smart specialization indicates a critically low level of overall awareness (arithmetic average 1.31 out of 5, where 5 indicates that information is complete and 0 indicates that information is not received). A high response variation coefficient (104%) indicates that experts in some sectors are narrowly informed on support activities in their particular area of smart specialization, while information on support activities in other areas is lacking. This reveals a crucial need to promote a broader and a more general level of information on support. As regards the significance of the support obtained, the expert analysis indicates that the support offered and provided by the Latvian and EU government institutions in the Vidzeme region for development and growth of smart specialization areas is *rather significant than insignificant* (*arithmetic average 2.78 out of 5 points)*, however, *the boundary is close to the value when the total support, according to experts, is rather insignificant than signi*ficant. This conclusion is particularly surprising in the area of financial aid, especially taking into account that the co-financing available within some of innovation growth supporting instruments is as high as 90–100%. The identified result is partly explained by the low level of information about the programs and evident unclearness of what the program specifically provides to the entrepreneur, as well as a clear understanding of the potential contribution of innovation to the company.

4 Major Obstacles and Barriers to Smart Specialization Growth in the Region

As the result of region's assessment, SWOT and expert analysis the following three main areas have been identified where Vidzeme region is currently facing the most significant obstacles and which have been identified as significant barriers to the implementation of smart specialization in Vidzeme region (Table 1).

Table 1. The main areas of obstacles for growth of smart specialization areas in Vidzeme region. Source: Expert survey, conducted by the authors of the research in the target group.

No.	The main obstacles to the development of smart specialization in Vidzeme region	Assessment in points*
1.	Entrepreneurship and innovation	**3.69**
2.	Human resources	**3.67**
3.	Cooperation between business, management, research and education sectors	**3.44**

*Grade scale for Table 1 and Table 2: 0 - No obstacle, 1 - Obstacle is insignificant, 2 - Obstacle is rather insignificant than significant, 3 - Obstacle is rather significant than insignificant, 4 - Obstacle is significant, 5 - Obstacle is very significant.

Thus, entrepreneurship innovations and human resources as a result of the study have been identified as the main areas that impede a faster growth of the region. The 5 most important specific obstacles have been separately distinguished: (1) Difficulties in providing skilled labour in rural territories (the obstacle is very significant (arithmetic average 4.53 out of 5 points, relatively low coefficient of variation (16%) showing a consensus); (2) Lack of qualified labour (the obstacle is very significant (arithmetic average 4.53 out of 5 points, relatively low coefficient of variation (21%)); (3) Complexity of language used in aid applications and reports which is difficult to understand (the obstacle is significant (arithmetic average 4.13 out of 5 points, low coefficient of variation (22%), indicating a consensus); (4) Bureaucratic burden of applying and receiving support (the obstacle is very significant (arithmetic average 4.13 out of 5, relatively low coefficient of variation (22%), indicating a consensus, (5) Outflow of talents and leaders (the obstacle is very significant (arithmetic average 4.00 out of 5, relatively low coefficient of variation (21%), indicating a consensus).

The Table 2 below summarizes the 10 most significant specific obstacles to the growth of smart specialization development in the region:

As in the case study, Vidzeme region, in order to ensure the development of smart specialization and competitiveness, it is necessary to significantly enhance communication in the target groups, significantly improving the information on smart specialization support activities in the region to wider target groups, it is necessary to support the availability of qualified labour, to significantly increase the level of awareness of companies and organizations on automation and digitalisation opportunities, to significantly reduce the bureaucratic burden of obtaining support and to develop mechanisms to help

Table 2. The main specific obstacles for growth of smart specialization areas in Vidzeme region. Source: Expert survey, conducted by the authors of the research in the target group.

No.	The main areas of obstacles for growth of smart specialization areas in Vidzeme region	Assessment in points (see footnote 2)	Coefficient of variation
		X	CV
1.	Difficulties in providing skilled labour in rural territories	4.53	16%
2.	Lack of qualified labour	4.20	21%
3.	Bureaucratic burden of applying and receiving support	4.13	22%
4.	Bureaucratic burden of applying and receiving support	4.13	22%
5.	Outflow of talents and leaders	4.00	21%
6.	Lack of understanding of market/s demand for innovations	3.93	22%
7.	Lack of financial resources of SMEs to implement innovations	3.87	31%
8.	Lack of financial resources of SMEs for R&D	3.80	33%
9.	Difficulties in attracting global leaders	3.80	28%
10.	Insufficient understanding of the available support tools	3.73	29%

the region to attract highly qualified talents and leaders with a significant potential to influence the region's growth vector. By identifying the major obstacles to a more productive introduction of smart specialization and competitiveness growth in the region, basic information has been obtained to assess the region's competitiveness opportunities in the future and to develop an action plan to ensure it. As the result of the research it can be concluded that the *issue of the region's current ability to perceive* the support provided is as important as the issue of strengthening the innovation capacity of the regions centrifugally, and, according to the case study of the specific region, the former is insufficient. The issue of sufficiently educated and innovative human capital and business environment in the region, which is able to turn the support provided into productive service and product, remains open. The study outlines the issue of choosing the most

efficient institutional actions to strengthen regional competitiveness by *push* or *pull*[2] approaches - whether educating the region's existing human capital and business innovation capacity public administration sector actions is more efficient than redirecting the innovative companies, already existing in the centres, to the regions, obtaining a faster growth in the regions as a result.

References

1. Storper, M.: Regional innovation transitions. In: Knowledge and Institutions Knowledge and Space, pp. 197–225 (2018)
2. Lagendijk, A., Cornford, J.: Regional institutions and knowledge – tracking new forms of regional development policy. Geoforum **31**, 209–218 (2000)
3. Rae, A., Singleton, A.: Open access and regional studies, regional science. Reg. Stud. Reg. Sci. **1**, 1–4 (2013)
4. Higgins, B., Savoie, D.J.: Lessons learned. Reg. Dev. Theor. Their Appl. **12**, 383–394 (2017)
5. Storper, M.: The city: centre of economic reflexivity. Serv. Ind. J. **17**, 1–27 (1997)
6. Brenner, R.M.: Reversible Suppression of Menstruation with Antiprogestins (2000)
7. Egashira, S.: Globalism and Regional Economy. Routledge, London (2015)
8. Gordon, G.L.: Reinventing Local and Regional Economies (2011)
9. Baker, M.J., Hart, S.: The Marketing Book, 6th edn. Elsevier, London (2008)
10. Batraga, A., Salkovska, J., Braslina, L., Legzdina, A., Kalkis, H.: New innovation identification approach development matrix. In: Advances in Intelligent Systems and Computing Advances in Human Factors, Business Management and Society, vol. 783, pp. 261–273. Springer, Cham (2018)
11. Cekuls, A.: Synthesizing the understanding of startup from different perspectives in business learning process at university. In: 10th International Multi-conference on Complexity, Informatics and Cybernetics, Proceedings, IMCIC 2019, vol. 2, pp. 137–140 (2019)
12. Cekuls, A.: Tool for forecasting overall success of business ideas for students of business management. In: 19th International Multidisciplinary Scientific GeoConference SGEM 2019, Ecology, Economics, Education and Legislation, no. 5.3, pp. 377–384 (2019)
13. Cox, K.: Urban and Regional Development Policy. Regional Economic Development and History, pp. 145–163 (2019)
14. Mitra, J.: Entrepreneurship, innovation and regional development. Entrepreneurship Innov. Reg. Dev. **08**, 1–27 (2019)
15. Salkovska, J., Batraga, A., Braslina, L., Skiltere, D., Braslins, G., Kalkis, H., Legzdina, A.: Four conceptual perspectives of innovation components. In: Advances in Intelligent Systems and Computing Advances in Human Factors, Business Management and Leadership, pp. 72–82 (2020)
16. Sloka, B., Kantane, I., Walczak, R.: The review of internet marketing use in Latvias companies. Int. J. Learn. Change **9**, 5–16 (2017)
17. OECD: Regional Development Policy. http://www.oecd.org/cfe/regional-policy/regionaldevelopment.htm
18. Cekuls, A.: Incentives affecting business students wish to start business. In: 19th International Multidisciplinary Scientific GeoConference SGEM 2019, Ecology, Economics, Education and Legislation, no. 5.4, pp. 177–182 (2019)

[2] The authors' outlined association with widely known and applied "push" and "pull" market strategies.

19. Cekuls, A.: The problematic of social issues and environmental. In: 18th International Multidisciplinary Scientific GeoConference SGEM 2018, Ecology, Economics, Education and Legislation, pp. 927–934 (2018)
20. Sander, T., Sloka, B., Kalkis, H.: Benefits of employees social network sites profiles for job applicants. In: Advances in Intelligent Systems and Computing Advances in Human Factors, Business Management and Leadership, no. 5.4, pp. 219–231 (2019)
21. Sander, T., Sloka, B., Kalkis, H.: Successful creation and communication of human resources strategies in Germany. In: Advances in Intelligent Systems and Computing Advances in Human Factors, Business Management and Society, pp. 249–260 (2018)
22. Monitoring of Smart Specialization Strategy. (Viedās Specializācijas Stratēģijas Monitorings). https://www.izm.gov.lv/images/zinatne/RIS3_pirmais-monitoringa-ziojums_2018.pdf
23. Policy Instruments to Support Local and Regional Innovation Ecosystems (ecoRIS3). (Vietējo un Reģionālo Inovāciju Ekosistēmu Atbalsta Politikas Instrumenti (ecoRIS3)). http://www.vidzeme.lv/lv/projekti/vietejo_un_regionalo_inovaciju_ekosistemu_atbalsta_politikas_instrumenti_ecoris3/info/
24. Eurostat. Glossary:Productivity. https://ec.europa.eu/eurostat/statistics-explained/index.php/Glossary:Productivity
25. Regional Studies (Reģionālie Pētījumi). http://www.vidzeme.lv/lv/regionalie_petijumi/50/128234/
26. Growth and Employment Supplement (Izaugsme un Nodarbinātība). https://www.esfondi.lv/upload/Planosana/DPP_gala_versija_30042015.pdf
27. Latvian National Development Plan 2014–2020. (Latvijas Nacionālās Attīstības Plāns 2014–2020). http://www.varam.gov.lv/lat/pol/ppd/ilgtsp_att/?doc=13858
28. 1.2.1.1. Support for Development of New Products and Technologies Within Centers of Excellence, 2nd Phase. https://cfla.gov.lv/lv/es-fondi-2014-2020/projektu-istenosana/1-2-1-1-atbalsts-jaunu-produktu-un-tehnologiju-izstradei-kompetences-centru-ietvaros-2-karta
29. Action Plan "Promoting Innovation in Small and Medium - Sized Enterprises 2018" (Rīcības Plāns "Mazo un Vidējo Uzņēmumu Inovāciju Sekmēšanai 2018"). https://issuu.com/vidzemesplanosanasregions/docs/ricibas_plans_ratio_2018

Econometric Modeling of Marketing Productivity for Service Sector

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Abstract. The absence of a universal measurement of marketing productivity highlights an inability to measure the influence of marketing assets on company results. It is important, therefore, to develop measures and quantifiable models of marketing productivity, making it possible to understand and evaluate company performance. Following a review of the literature on the topic, this paper sets forth a Theoretical Model of Marketing Productivity (MTPM), to serve as a base for carrying out measurements of productivity through the identification of their determinant variables. The obtained results establish that marketing resources, financial performance, and price all exercise a positive effect on marketing productivity, while market-based assets exercise a negative effect.

Keywords: Marketing productivity · Retail business · Financial performance

1 Introduction

From the Neoclassic Theory of Economics, productivity represents the conversion, in economic terms of the input to a process (work, capital) to the desirable output in terms of the output sought (sales, earnings) [1]. This relationship is expressed and maintained over time in different existing definitions: measurement of efficiency as a combination of the uses of productive resources, including capital and labor [2]; the ratio between units of obtained results and units of effort or necessary expenditures in order to obtain the output [3]; the relationship established between production (output) and consumption (input), both measured in physical units [4].

Marketing productivity is understood to mean the quantifiable added value of the function of marketing with regard to investments [5]. Thus, the achievement of a higher level of productivity by a company will correspond to suitable returns, as much in terms of benefits as in the value created for customers [6]. Although conceptual and operational definitions of marketing productivity exist, there is no agreement on a universal definition [5]. For example, [7] defines marketing productivity as the ratio between the effect produced and the energy spent, which, from the point of view of marketing, would be the ratio of sales or net benefits (effect produced) to the costs of marketing (energy spent) for a specific segment of business; [8] understand it as the ratio of output, or production

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results, to the corresponding inputs (economic resources), both during a given period of time, and [9] define it as the relative price of participation in the market over the marketing costs of the company.

As has been noted, one of the main problems associated with the measurement of marketing productivity is derived from the intangibility of its variables [10], which makes it difficult to justify the investments destined for productive increases, and even to maintain adequate levels of productivity. In order to make this justification, it is necessary to be able to quantitatively measure marketing productivity so that the viability and usefulness of its activities can be justified [5, 10, 11].

2 Theoretical Framework

It is necessary to establish the factors that determine marketing productivity as a first step in carrying out its measurement. Price is one of these factors, since in order to raise the level of marketing productivity, it is necessary to take into account all activities that have an impact on the acquisition and retention of customers [5]. Thus, marketing productivity could be increased by controlling such aspects as sales, product development, advertising and, of course, by defining suitable pricing levels [12]. Determining price levels allows organizations to increase their level of customer retention in order to be able to count on adequate budgets that allow them to carry out the marketing activities necessary to reach their proposed objectives [13]. Therefore, a positive relationship can be seen between price and companies' marketing productivity [5], taking into account that prices must maintain the levels of customer satisfaction and retention, in addition to fulfilling the profitability objectives of the organization. The idea consists of defining price levels with the goal of keeping customers satisfied in the long term [14], and not to attempt to fulfill only one function of the maximization of prices. This allows us to establish the first hypothesis of the investigation: Hypothesis 1: Price levels defined by the organization will positively affect marketing productivity.

The marketing assets of organizations that affect marketing productivity can be classified by diverse criteria; for example, the degree of tangibility of their attributes, and their physical or human, intellectual or capital performance. That is to say, these assets gather all that can be used to attain a competitive advantage in the markets. Given the complexity of measurement of these concepts, and to facilitate their description and later measurement, in addition to associating and identifying marketing resources with marketing assets, [15], define the concepts as i) base market assets and ii) marketing support resources. The first are those that can be delivered directly in the market, and the second are those that allow the development of activities that contribute indirectly to generating a competitive advantage. Base market assets consider four elements: i) the ability to identify what the customer wants, creating suitable relationships; ii) the reputation and credibility of the organization among its customers, suppliers and distributors; iii) the ability to innovate in the market, and iv) the human resources of the organization that generate staff development and increase employee loyalty and motivation. Marketing support resources incorporate two elements, the marketing culture of the organization, and the ability of management to conduct, coordinate and motivate these activities. Thus, in a company that is oriented to the market, the resources fit the organization, based on experience and tacit understanding, making it difficult for competitors to copy or imitate.

The results of the study by [15], demonstrate a negative correlation between market orientation and active reputation. This correlation arises from the fact that well-established companies in the market, with a high reputation and an offer of well-known brands, can become myopic, failing to be alert to the signs that the media gives them and, in some cases, can become complacent. The earlier success of these companies leads them to a certain degree of arrogance, thus neglecting the market. The other negative relationship that exists is produced between the assets of human resources and financial performance that are indirectly linked through customer performance, which underlines the importance of motivation and training of staff to prevent company effectiveness from being adversely affected. Thus, those investments that companies undertake in base market-based assets will have a negative effect on financial performance and on marketing productivity. Thus, we establish: Hypothesis 2: Investments in market-based assets will negatively affect financial performance. Hypothesis 3: Investments in market-based assets will negatively affect marketing productivity.

Company resources or marketing assets can also affect marketing productivity [11]. Marketing assets are found to be focused on the value of customers to the company, enhancing company value in the long term, and directly and positively affecting its cost-effectiveness. Generally, resources or marketing assets tend to be grouped in the value of the brand and the value of the customer. The value of the brand corresponds to the knowledge that the customer has of the brand, which would produce an intermittent increase in cash flow, as a response to brand awareness by the customer [16], and the value of the customer is defined as the sum of the net present value of his life cycle. Notable among studies of the positive effect that brand value has on the market value of the company, are those by [17], who calculate the fraction of cash flow of the organization that is attributed to the brand value, and by [18], who relate the brand value to the ROI, finding a positive relationship between the variations presented in the brand value and the value of marketing activities. With regard to customer value, [15] emphasize that it should be one of the main focal points of companies' marketing activities, which should be developed so as to identify customers of greater value, to decrease the costs of acquisition, and to devise marketing projects. [19] present a structure that allows the understanding of the way in which customer value affects shareholder value, using the value of the customer as an intermediary [11]. Thus, we establish: Hypothesis 4: Marketing resources will positively affect financial impact or performance. Hypothesis 5: Marketing resources will positively affect marketing productivity.

The fourth determinant of marketing productivity corresponds to the investments in marketing made by the company. When thinking about reducing costs, the main objective tends to refer to marketing activities, since these are the easiest to justify. It must be taken into account that, if a company opts for an increase in productivity, complications arise from its measurement, especially in the service sector, due to the intangibility of its product [10]. Therefore, to avoid decreases in marketing investments, adequate levels of productivity should be maintained. If it were possible to measure this productivity quantitatively, the viability of marketing activities could be demonstrated, considering these more as an investment than as an expense. It is necessary to point out that care must be taken, lest the functions of marketing become routine, since they can be absorbed by other business functions, thus creating the perception that greater expenditures on this

activity decrease marketing productivity [5]. Therefore: Hypothesis 6: The investments in marketing by the company that are directly associated with marketing activities of the organization will negatively affect financial impact or performance. Hypothesis 7: Marketing investments undertaken by the company that are directly associated with marketing activities of the organization will negatively affect marketing productivity.

A measurable result of the previously analyzed factors, investments in marketing, marketing resources and marketing-based assets, is financial impact or performance [11, 15]. Thus, there will be a positive relationship between the financial performance of the company and its marketing productivity [11, 17]. Financial performance can be measured by the ratio ROI, since, despite the fact that this indicator only provides results in the short term, it allows us to consider marketing expenses as an investment, measuring financial returns through marginal profit, which are in turn measured through percentage increment. This allows the inclusion not only of the increases in income of the organization but also the expenditures necessary to reach them [11]. In the literature of marketing productivity, the rationale most employed for its measurement is marketing expenses measured through the factor of work. On the other hand, the output predominantly employed as numerator considers the added value of companies in economic terms [20]. Thus, an increase in the financial impact or performance of the company will lead to an increase in marketing productivity. That is to say, if the company obtains greater financial profitability, it is due to the fact that it has invested correctly in marketing activities. This relationship gives rise to the next hypothesis of our research: Hypothesis 8: The increase in the financial performance of the company will increase marketing productivity.

The necessity to analyze the efficiency and effectiveness of marketing productivity emerges when the expenditures of marketing in the total cost of the company increase, which could cause a loss of competitiveness. There are various strategies to achieve appropriate levels of productivity; for example, through the more efficient use of company resources or the maximizing over time of the ROI. Another way of achieving suitable levels of productivity consists of including concepts of efficiency and effectiveness in the company's marketing productivity, with the goal of developing a productive marketing structure [5]. Therefore: Hypothesis 9: Marketing productivity is positively related to technical efficiency.

3 Methodology and Results

In order to validate the proposed MTPM in the services sector, an application is made to the Spanish retail business sector. The database used has been obtained from SABI (System of Analysis of Iberian Balance Sheets). At the time the study was carried out, the SABI database contained a record of the accounts, ratios, activities, stockholders and investee companies of more than 1,000,000 Spanish companies and 250,000 Portuguese companies. Spanish retail companies were selected, using the classification established by the Codes of National Classification of Economic Activities (CNAE). According to this criterion, the companies selected belong to "Retail business, except Motor Vehicles, Motorcycles and Mopeds; Repair of Personal Effects and Household Equipment."

Determining the factors that influence levels of performance as well as quantifying their influence is done through a cross section of econometric methodologies and panel

data. Specifically, through the cross-section models, static or permanent characteristics of the Spanish retail business sector are taken into account and, through the panel models, temporal effects of this sector are considered [21, 22].

The MTPM will be validated for the specific case of the Spanish retail business sector, measuring marketing productivity through the productivity of the work factor. The economic model that serves as the basis is that of Cobb-Douglas [1]. As has been established in MTPM, the dependent variable used is marketing productivity, and the independent variables are the number of employees, the marginal benefit (percentage increase), and total assets, as a measurement of capital.

To validate the model, various tests are employed: White's test to contrast heteroskedasticity, the Durbin-Watson test to contrast auto-correlation, and the Jarque-Bera test to verify the normality of the residuals. The obtained results for these tests validate the hypotheses of the proposed model of regressions [23, 24].

Thus, the productivity model based on the Cobb-Douglas function is specified in the following way:

$$MarketingProductivity\ (V.A./Staff\ \ Expenditure) = e^{(-2.49)} * Number\ of\ \ Employees^{-0.14} * MarginalBenefit^{0.075} * TotalAssets^{0.22} \tag{1}$$

All the variables incorporated in the model are highly explanatory of the productivity of the retail companies of the sample in the period 2010 (Adjusted$R^2 = 45\%$; F-statistic = 25.62, P-value = 0.0000, $\alpha = 0.01$; White: F-statistic = 3.76, P-value = 0.0022; Durbin-Watson = 1.968, dL = 1.421, dU = 1.670, $\alpha = 0.01$). While the number of employees negatively affects the productivity of the retail companies, the total of assets and marginal benefits has a positive effect. These results allow the validation of the hypotheses proposed for the MTPM in the Spanish retail business sector, with the exception of the hypothesis that relates the variable price to marketing productivity, since it has not been able to be tested in this model.

The major influence on marketing productivity is exerted by marketing resources, measured by total assets, which produces an increase of 0.22% in productivity if the total assets are increased by 1%. The effect of market-based assets, measured through the number of employees, has a negative effect on marketing productivity presented in the MTPM, since an increase of 1% in the number of employees produces a decrease of 0.14% in marketing productivity.

An increase of 1% in the marginal benefit produces an increase of 0.075% in marketing productivity, thus validating the use of marginal benefit as a proxy variable of marketing productivity, since the resulting sign is more significant than the value of the relationship.

4 Conclusions

Since a non-productive use of company resources has direct negative effects on benefits and profitability, the research developed is especially significant. The main objective of this research, constituting its principal value, is the proposal and validation of models of

measurement of the impact of marketing resources on the financial position of companies, thus allowing an explanation of the relationships that exist among the distinct components of the marketing productivity of organizations.

Among the limitations of the research are the size of the sample, the geographic sphere analyzed (Spain) and dealing with an analysis that does not consider the specific situation of each individual company within the sample. In addition, due to a lack of the necessary information in the database, it was not possible to contrast the influence of investments in marketing by the companies, nor to measure the technical efficiency of companies in the sector. Another limitation was the lack of qualitative information available in the database studied, which could have permitted the incorporation of these measurements in the theoretical models presented. These limitations highlight the necessity for all research to rely on databases as complete as possible; they open the way to broadening the study to other databases, and in other geographic, sectorial and business contexts, in which the inclusion of all relevant financial and accounting indicators may be feasible.

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References

1. Solow, R.: A contribution to the theory of economic growth. Quart. J. Econ. **70**, 65–94 (1956)
2. Fabricant, S.: A Primer on Productivity. Random House Ed., New York (1969)
3. Bucklin, L.P., Takeuchi, H.: Productivity in retailing: retail structure and public policy. J. Retail. **53**(1), 35–46 (1977)
4. Diéguez, J., González, V.: Precisiones en torno a los conceptos de productivity, eficiencia, eficacia, rendimiento y economicidad. Costos y Gestión **3**(12), 275–291 (1994)
5. Sheth, J., Sisodia, R.: Marketing productivity, issues and analysis. J. Bus. Res. **55**, 349–362 (2002)
6. Grönroos, C., Ojasalo, K.: Service productivity: towards a conceptualization of the transformation of inputs into economic results in services. J. Bus. Res. **57**, 414–423 (2004)
7. Sevin, C.: Marketing Productivity Analysis, p. 130. McGraw Hill, St. Louis (1965)
8. Beckman, T.N., Davidson, W.R., Talarzyx, W.W.: Marketing, 9th edn, p. 872. The Ronald Press, New York (1973)
9. Hawkins, D., Best, R., Lillis, C.: The nature and measurement of marketing productivity in consumer durable industries: a firm level analysis. J. Acad. Mark. Sci. **4**(15), 1–8 (1987)
10. Keh, H., Chu, S., Xu, J.: Efficiency, effectiveness and productivity of marketing in services. Eur. J. Oper. Res. **170**, 265–276 (2006)
11. Rust, R., Ambler, T., Carpenter, G., Kumar, V., Srivastava, R.: Measuring marketing productivity: current knowledge and future directions. J. Mark. **68**, 76–89 (2004)
12. Moe, W., Fader, P.: The role of price tiers in advance purchasing of event tickets. J. Serv. Res. **12**(1), 73–86 (2009)
13. Dawes, J.: The effect of service price increases on customer retention the moderating role of customer tenure and relationship breadth. J. Serv. Res. **11**(3), 232–245 (2009)
14. Shapiro, C., Varian, H.: Information Rules: A Strategic Guide to the Network Economy. Harvard Business School Press, Cambridge (1999)

15. Hooleya, G., Greenleya, G., Cadogana, J., Fahy, J.: The performance impact of marketing resources. J. Bus. Res. **58**, 18–27 (2005)
16. Keller, K.: Strategic Brand Management. Prentice Hall, Upper Saddle River (1998)
17. Simon, C., Sullivan, M.: The measurement and determination of brand equity. Mark. Sci. **12**(1), 28–52 (1993)
18. Aaker, D., Jacobson, R.: The financial information content of perceived quality. J. Mark. Res. **31**, 191–201 (1994)
19. Berger, P., Eechambadi, N., George, M., Lehmann, D., Rizley, R., Venkatesan, R.: From customer lifetime value to shareholder value - theory, empirical evidence, and issues for future research. J. Serv. Res. **9**(2), 156–167 (2006)
20. Cummins, J., Weiss, M.: Consolidation in the European Insurance Industry: Do Mergers and Acquisitions Create Value for Shareholders?. University of Pennsylvania, Wharton Financial Institutions Center. Pennsylvania, U.S. Documento de Trabajo, N° 2 (Enero), p. 52 (2004). Disponible en: http://fic.wharton.upenn.edu/fic/papers/04/0402.pdf. Leído 15 de Julio de 2008
21. de la Fuente-Mella, H., Marzo, M., Reyes, M.J.: Análisis de la satisfacción universitaria en la Facultad de Ingeniería de la Universidad de Talca. Ingeniare. Revista Chilena de Ingeniería **18**(3), 350–363 (2010)
22. Coughenour, C., Paz, A., de la Fuente-Mella, H., Singh, A.: Multinomial logistic regression to estimate and predict perceptions of bicycle and transportation infrastructure in a sprawling metropolitan area. J. Public Health **38**(4), 401–408 (2016)
23. Paz, A., de la Fuente-Mella, H., Singh, A., Conover, R., Monteiro, H.: Highway expenditures and associated customer satisfaction: a case study. Math. Probl. Eng. **2016**(4630492), 1–9 (2016)
24. De la Fuente, H., Vallina, A.M., Solis, R.: Stochastic analysis of the economic growth of OECD countries. Economic Research-Ekonomska Istraživanja (2019). https://doi.org/10.1080/1331677x.2019.1685397

Downstream Intra-organizational Product Market Competition Between Employees: A Theoretical Approach

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Abstract. To investigate the downstream internal competition and its effect on firm's performance comprehensive literature review has been conducted. The concentration is on recognized social dimensions, similar focus is on communications, interactions and interrelationship between departments and business units. The Integration of intra-organizational competition and internal social comparison balances the literature review. Although it is quite controversial to practice and encourage internal competition having it's sustained effect on behavioral of employees. The basis of literature review relies on human tendency to compare and coordinate work activities inside firm's boundaries. The literature emphasizes on the link between the construct of intra-organizational competition and barriers for employees to function effectively. The Author concluded that there is a lack of systematic literature review which aims to test theoretical link between downstream product market competition affecting employee's contribution towards "firms performance" from organizational point of view as per author's current knowledge and available information.

Keywords: Intra-organization · Competition · Working environment · Downstream · Performance

1 Introduction

The theoretical framework of research has focus on two major variables and critical factors that affects the working environment within firm due to intra-organizational strategy of competitive behavior implemented by employers' that foster "Intra-organizational competition". Intra-organizational competition is the resultant of intra-organizational social comparison that exists between individuals, divisions and team leaders [1]. It is a process that emerges during period of time. The internal social comparison give rise to competitive behavior that intern leads to internal competition followed by intra-organizational competition (Fig. 1).

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Fig. 1. Transition process of Intra-organizational competition [1].

The psychology of social comparison is influenced by the process of interaction between individuals at workplace. Stakeholders holders such as employees, managers, supervisors compare individual abilities. The action and reaction between workers shape working environment and affects behavior [2].

The authors revealed social comparison have three main variables that increases comparison concerns [3]. First it intensifies with the relevance of performance dimension to the participant [4] such as performance in sports, profession, income and academics. Second is the degree of the participant's similarity to the target [5, 6] meaning that similar rivals exhibit greater comparison concerns than those less similar ones. Third variable is the degree of the Participant's relationship closeness to the target [7] where comparison concerns are stronger when the target is interpersonally close and interact regularly such as colleagues and subordinates.

When situational factors collide with individual factors it gives rise to comparison concerns followed by competitive behavior (Fig. 2). It turns out these competitive behavior forms social aspirations for achieving better salary, remuneration, increment and promotions in job. In the event of internal competition, the role of business administration has been critically scrutinized from the employee's perspective. Some of the examples of sustaining competitive environment deployed by Google and Microsoft use leader boards or stack ranking to encourage employees for better performance. Not all employees are competition ready. The intra-organizational competition affects their behavior and diminishes their response time to the situation prevailing in working environment. The effects are treating colleagues as competitors, sense of rivalry starts developing between subordinates, as a result tension mounts, and behavioral attitude reflects uneasiness [1]. Many authors have revealed in their studies based on macro and micro level analysis looking at social comparisons identified potential damaging effects about the culture of these organizations fosters unethical behavior to improve an individual's standing that also includes envy, dishonest behavior [9] and potentially excessive risk taking [10]. The criticism of intra-organizational competition raises question, whether is it beneficial to encourage or to discard social comparison. If it is encouraged, how far organizations can proceed and if it is restricted what will be the limits or boundaries can be drawn so it cannot escalate further.

On the other side intra-organizational competition has yield many advantages for organization's performance [11, 12]. In contrast to the relative nature of employees it has been found out the efforts are much higher from them when they indulge themselves in competition spirit and felt like competitors among themselves [6].

There are organizations listed in fortune 500 use intra-organizational competition to ensure performance and growth. For e.g. [1] General Electric Corporation, use internal

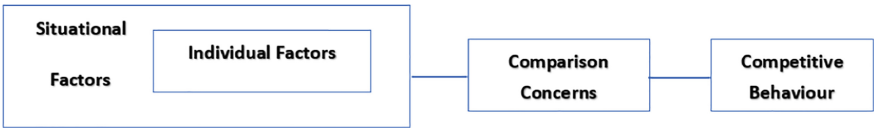

Fig. 2. The social comparison model of competition [8], The basic building blocks of individual factors, encompassed by situational factor together influenced the degree of comparison concerns develop competitive behavior.

competition as a strategic tool for enhancing productivity, utilizing resources efficiently and improving the effectiveness of their business operations. [13] "internal competition between divisions, business units and individuals for performance, bonus and promotion is a fundamental feature of management system in GMC's organizational culture". According to [14] many firms have made critical decisions regarding the 'allocation of resources' for competing internally and use it as one of the major instruments for "strategic investment opportunity". Proctor & Gamble, IBM, Digital, Johnson & Johnson, Wang, and Hewlett-Packard use one or another form of direct internal competition [15].

Fuji Xerox, Ericsson and Lucent [16]; Motorola [17] Rubbermaid's management strategy focus on creating great deal of direct internal competition. "Competition between teams and business units for resources is healthy in DuPont" the emphasize is on selling new ideas to administrators by building internal support and then force promoter for the availability of resources and in Fidelity competition between two teams for same opportunity encourages fertile internal competitive environment [18].

2 Theoretical Approach and Methodology

The existence and presence of internal social comparison give rise to intra-organizational competition in and it is quite challenging to investigate empirically. To establishing ground theories for constructing stable research framework systematic approach and effective methodology has been used. The construct of intra-organizational competition is primarily based on internal social comparison between employees working within firm either in team or on individual assignments. For the purpose of research, a systematic literature review has been conducted, many publications have been explored through scrutinizing recognized scientific academic journals during the period of 1950's till date (Table 1). The search criteria include the use of key terminologies taken from research title and specific sentences has been used to found out mandatory Literatures of Intra-organizational competition and comparisons.

There are many factors considered for the purpose of selecting the relevant article reviews (Table 2).

From Table 2 the total number of articles collected and considered for studies stands out to 47. Table 3 represents the category of articles collected for the purpose of research.

After the process of selection and collecting various relevant and recognized articles following analysis has been done in consideration to the two major variables used in research. Enlisting author's research on the factors related with intra-organizational

Table 1. Methodology of selected articles

Terminology	Google Scholar	Emerald Insight	EBSCO	Science Direct
Intra-organizational competition between employees in firm	25	13	15	17
Intra-organizational Comparison between employees in team	22	15	12	21
Internal social comparison between employees within firm	12	17	18	23
Downstream product market competition between employees	15	9	8	11

Table 2. Selection of reviewed articles

Abstract reading/Full revision of article	Literature review/Research methodology	Conceptual framework	Quantitative analysis/Qualitative analysis	Implication/Limitation	Future research
198/221	207/188	175	167/72	145/157	212

Table 3. Collection of reviewed articles

Literature review	Case study	Survey	Interview	Modelling	Stat. ana.	Test/exp.	Tool/concept
19	7	17	11	9	28	22	13

competition and internal social comparison. It establishes the link between intra-organizational competition and internal social comparison. The literatures considered for study has been associated with downstream product market competition (Table 4).

The degree of separation between competition and comparison is very marginal. Issues regarding critical factor such as remuneration, ethical behavior and jealousy intensify competition between fellow members and colleagues. It has a definite impact on the capacity of employees to perform. In context cooperation and coordination can be compromised with in the team and between the functionality of various departments. The significance of wage cut, and wage rise determines the effort level of subordinated working within team or in other departments.

Under these circumstances an employee working for an employer might pull back the efforts which is required for optimum productivity. The commonalities such as increase in wages results in increase of performance and reduction in wages resulting in reduction of performance. Also, it has been observed the level of competition between few workers is less as compared to the intensity of competition among large group of workers.

Table 4. Intra-organizational competition V Internal social comparison

References	Theory & Concept	Variable & Sample	Data collection & Analysis	Research implication & Findings
Baumann, O., Eggers, J. P., & Stieglitz, N., (2019) [1]	Upstream social comparison influencing downstream product market competition	Intra-organizational competition, Managerial ability, allocation of resources, Performance and adaptation. N = 10 business units, R = 50 resources allocation, 1000 times step analysis of 10000 replication	Survey methods for quantitative analysis and data collection has been used. Long-normal distribution, Mean, standard deviation, Robustness testing by using hybrid benchmarking and linear combination	Upstream social comparison affects firm-level outcome and the effects were related to downstream product market competition are complementary. Workers benchmark their performance against each other has overall implications on firm's performance
Mena, C., Humphries, A. S., & Wilding, R., (2009) [20]	Based on the concept of Inter-organization and Intra-organizational relationship	Market Transaction, Open market negotiations, Price adversarial, and Supply chain collaboration. 29 respondents form brewing and 17 respondents form case related to poultry were used	38 closed ended questions with five-point Likert scale has been used for analysis	Intra-organizational relationships have lower levels of collaboration than inter-organizational ones. These two types of relationship contradict the validity and generalizability of relationship
Hu, Songcui; He, Zi-Lin; Blettner, Daniela P.; Bettis, Richard A., (2017) [22]	Behavioral Theory highlights the crucial role of social comparisons in attention allocation of adaptive aspirations from social reference and political reference point of view	Social reference, political reference, social comparison, consistent and inconsistent feedback. 267 German magazines from 1972 to 2010, belong to 60 different publishers in 21 different categories. Final sample of 11,675 observations from 156 magazines	Interviews with 10 managers of magazines and three publishers. A grid search to estimate attention weights along with linear programming and non-linear functions has been taken into consideration. Regression analysis has been carried out	Comparing performance with 2 reference point gives consistent or inconsistent result. consistent feedback leads to more attention to experience while inconsistent feedback result in more attention to social reference. As a result, political reference point play an important role

(*continued*)

Table 4. (*continued*)

References	Theory & Concept	Variable & Sample	Data collection & Analysis	Research implication & Findings
Benndorf, V., Rau, Holger A., (2012) [19]	Based on the competition analyses between workers in a gift-exchange experiment where two workers hired by the same employer	Only one employee per employer. 3 firms, 3 employer and 3 employees in a SET of 54 and in MET 36, overall, 90 participants	Experimental approach has been used to gather data through tournament incentive. Two-sided Mann Whitney test has been performed along with regression analysis	Employing more than one worker clearly improves the effort level of other employees. Multiple employees feel the competitive pressure and they increase effort level
Charness, G., and Kuhn, P., (2007) [21]	Workers behavior in an efficiency wage environment in which co-workers' wages can influence worker's effort. Theoretical, experiment shows increase in workers' response to co- workers' wages leads to profit	Offered Wages, Effort cost and revenue, Public-Wage Regime, Co-worker Wage Offers. University of California, Santa Barbara, 18 students participated in 4 sessions, 15 students in one of the sessions, and 12 in two sessions	Participants were recruited using an e-mails. Since no person participated in more than one session, there were thus 111 different participants. Efforts cost and revenue were calculated through linear programming. Regression analysis and mean values were calculated	3 out of 6 specifications estimated the effect of relative wages on a low-productive worker's effort is negative. counter to what one would expect from other case but in all cases the effect is statistically insignificant. In conclusion widespread intuition jealousy play a key role in workplace
Cohn, A., Ernst, F., Herrmann, B., Schneider, F., (2011) [23]	A randomized field experiment to examine how workers respond to wage cuts, and whether their response depends on the wages paid to co-workers. Workers performed identical individual tasks and received the same performance in an hourly wage	Social comparison, Wage in Fairness, Incentives offered, Relative performance. sample consists of 96 workers in 48 teams	Implementation of difference-in-difference setup with a pre-and post-intervention phase. Standard error of the mean deviation showing average treatment effects on individual work performance. Also, the logarithmic average performance showing standard errors and cluster over teams followed by the descriptive statistical analysis	General wage cut reduced workers' performance by 15% relative to the baseline treatment, while those workers whose wages were lowered in the unilateral wage cut treatment reduced their performance by 34%. Result suggests that social comparison can have powerful and large effects on worker behavior

3 Conclusion

Intra-organizational competition in the context of internal social comparison escalates when individuals within organizations compares their relative standing. The literatures which has been used for research pointed out downstream product market competition based on facts and figures associated with their attitude and ability to make contribution towards the firm's performance.

The team dynamics can change while working in downstream production capacity as two team gets locked to develop products or willing to solve similar operational challenges leads to duplication of cost and authority of command. Another important factor which has most likely impact on the outcomes of firm's performance is managerial capability to integrate the level of competition and individual's ability to perform positively. The balance between the expected level of competition and perform has been critically examined by researchers. There are questions on execution of intra-organizational competition affecting employee's behavior. These firms either cultivate irrational behavior, excessive risk taking can turn colleagues into competitors or successfully developed an environment for mutual growth and co-existence.

References

1. Baumann, O., Eggers, J.P., Stieglitz, N.: Colleagues and competitors: how internal social comparison shape organizational search and adaptation. Adm. Sci. Q. **64**(2), 275–309 (2019)
2. Gartenberg, C., Wulf, J.: Pay harmony? Social comparison and performance compensation in multi business firms. Organ. Sci. **28**, 39–55 (2017)
3. Festinger, L.: A theory of social comparison processes. Hum. Relat. **7**, 117–140 (1954)
4. Hoffman, P., Festinger, L., Lawrence, D.: Tendencies toward group comparability in competitive bargaining. Hum. Relat. **7**, 141–159 (1954)
5. Goethals, G., Darley, J.: Social comparison theory: an attributional approach. In: Suls, J., Miller, R.L. (eds.) Social Comparison Processes: Theoretical and Empirical Perspectives, Washington, DC, pp. 259–278 (1977)
6. Kilduff, G.J., Elfenbein, H.A., Staw, B.M.: The psychology of rivalry: a relationally-dependent analysis of competition. Acad. Manag. J. **53**, 943–969 (2010)
7. Pleban, R., Tesser, A.: The effects of relevance and quality of another's performance on interpersonal closeness. Soc. Psychol. Q. **44**, 278–285 (1981)
8. Garcia, S.M., Tor, A., Schiff, M.T.: The psychology of competition: a social comparison perspective. Perspect. Psychol. Sci. **8**(6), 634–650 (2013)
9. Charness, G., Masclet, D., Villeval, M.C.: The dark side of competition for status. Manag. Sci. **60**, 38–55 (2013)
10. Kacperczyk, A., Beckman, C.M., Moliterno, T.: Disentangling risk and change: internal and external social comparisons in the mutual fund industry. Adm. Sci. Q. **60**, 228–262 (2015)
11. Vidal, J.B.I., Nossol, M.: Tournaments without prizes: evidence from personnel records. Manag. Sci. **57**, 1721–1736 (2011)
12. Stark, O., Hyll, W.: On economic architecture of workplace: repercussions of social comparison among heterogeneous workers. J. Labor Econ. **29**, 349–375 (2011)
13. Grant, R.M.: Contemporary Strategy Analysis. Wiley, Chichester (2013)
14. Donaldson, G.: Managing Corporate Wealth: The Operation of a Comprehensive Goals System. Praeger Publication, New York (1984)

15. Peters, T.J., Waterman, R.H.: In Search of Excellence: Lessons from America's Best-Run Companies. Warner Books, New York (1988)
16. Birkinshaw, J.: Strategies for managing internal competition. Calif. Manag. Rev. **44**, 21–38 (2001)
17. Caroll, B., Tomas, S.: Team competition spurs continuous improvement at Motorola. Natl. Prod. Rev. **14**, 1–9 (1995)
18. Kanter, R.M., Kao, J.J., Wiserman, F.D.: Innovation: Breakthrough Ideas at 3M, Dupont, GE, Pfizer, and Rubbermaid. Harper Business, New York (1997)
19. Benndorf, V., Rau, H.A.: Competition in the workplace: an experimental investigation. DICE Discussion Paper, 53, ISBN 978-3-86304-052-9, DICE, Düsseldorf (2012)
20. Mena, C., Humphries, A.S., Wilding, R.: A comparison of inter and intra-organizational relationship: the two case studies from UK food and drink Industry. Int. J. Phys. Distrib. Logist. Manag. **39**(9), 762–784 (2009)
21. Charness, G., Kuhn, P.: Does pay inequality affect worker effort? Experimental evidence. J. Labour Econ. **25**(4), 693–723 (2007)
22. Songcui, H., Zi-Lin, H., Blettner, D.P., Bettis, R.A.: Conflict inside and outside: social comparisons and attention shifts in multidivisional firms. Strateg. Manag. J. **38**(7), 1435 (2017)
23. Cohn, A., Ernst, F., Herrmann, B., Schneider, F.: Social comparison in the workplace: evidence from a field experiment. IZA Discussion Papers, No. 5550, Institute for the Study of Labour (IZA), Bonn (2011)

Human Oriented Ecosystem Development and Community

Open Ecosystem for Smart Mobility System Operation and Maintenance

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Abstract. In this study, we provide novel insight into operating and maintaining a heterogeneous and expanding vehicle fleet in a smart city environment. Smart mobility is booming and comprises an important part of the development of smart cities. City bikes are already widely used in many cities and new types of vehicle, such as scooters, have already entered the market. Smart mobility systems also create new infrastructure in cities that requires daily operation and maintenance. Poorly managed operation and maintenance causes low usage of smart mobility systems and on the other side, can be very costly to cities. Therefore, we provide a novel method according to Industry 4.0 standards to manage the challenges with the help of an open platform that connects smart mobility systems and service providers.

Keywords: Smart mobility · Digital ecosystem · Industry 4.0 · Smart services

1 Introduction

Smart mobility is an extension to the traditional public transport system and therefore has an important role in supporting the functioning of an urban area. Smart mobility has emerged to address challenges that affect the quality of life in cities, such as traffic congestion and excessive time to travel across the city, which have a negative impact on citizens' work-life balance, the cost of public transport services, etc. (Benevolo et al. 2016). Smart mobility systems also create new infrastructure in cities that requires daily operation and maintenance. There is a risk that if the new infrastructure is poorly managed, it will be costly to operate and maintain, and the quality of life of citizens may not improve as imagined. In order for the smart mobility to provide value for money (Grönlund et al. 2011; Midwinter 1994) it should be economical, efficient and effective. The *economy* perspective deals with how well the costs of resources are minimized in resource integration. *Efficiency* relates to the relationship between output and input used to co-produce the service, in other words, providing a specified volume and quality of service with the lowest level of resources capable of meeting the specification (Grönlund et al. 2011). *Effectiveness* focuses on the extent to which the organization, i.e., the smart city, can achieve its objectives (Jussila et al. 2017). Building on existing research, we aimed to answer the following research questions:

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– How to create an open ecosystem that is economical, efficient and effective regarding operation and maintenance for the smart mobility system.
– Can we apply the I4.0 reference architecture RAMI 4.0 and IIRA to the smart mobility system and how do they support interoperability?

2 Theoretical Background

2.1 Operation and Maintenance of Smart Mobility Systems

New business models that utilize a sharing economy model in the mobility market have gained momentum in many cities (Acquier et al. 2019; Hamari et al. 2016; Yin et al. 2019). One example of a sharing economy model is the bike-sharing system, which has experienced a tremendous boom in many cities (Loidl et al. 2019). Consequently, we can state that the market for different mobility solutions using a sharing economy model is growing rapidly. In this paper, we use the term smart mobility system to describe an overall system containing two or more mobility solutions for sharing purposes. In practice, this could be two different bike-sharing systems used in one city or it could also be one bike-sharing system and one scooter-sharing system used in parallel in the same location.

Naturally, this opens new business opportunities. One such opportunity is smart mobility system operation and maintenance, since companies providing transport services do not always have the capability to operate and maintain their vehicle fleet effectively. The core competence for the transport service providers is different from that required for the technical operation and maintenance of the fleet. Consequently, there are companies focusing on this new niche market, providing vehicle fleet operation and maintenance. In the literature, there are several studies on managing mobility as part of a sharing economy for mobility users, along with methods of mobility system planning (Docherty et al. 2018; Faber et al. 2018; Ji et al. 2014; Loidl et al. 2019). On the other hand, there is a gap in the literature relating to the successful operation and maintenance of smart mobility systems.

The operation and maintenance of smart mobility systems fits well into the platform economy model, because there are consumers for the maintenance (vehicles) and providers of the maintenance (maintenance personnel) (Pulkkinen et al. 2019). Due to the emergence and exploitation of the platform economy, new ways of co-creating value in the business ecosystem have been created. This has led to the development of the digital business ecosystem concept, which combines the two main tiers of digital platforms and the business ecosystem, and is defined as a "sociotechnical environment of individuals, organizations and digital technologies with collaborative and comparative relationships, aiming to co-create value through shared digital platforms" (Senyo et al. 2019).

2.2 I4.0 Reference Architecture IIRA and RAMI 4.0

A strategic initiative called "Industrie 4.0" (I4.0) was first proposed by the German government in 2012, when they launched the "High-Tech Strategy 2020 Action Plan"

with the aim of improving Germany's industry competitiveness against growing Asian economies (Thoben et al. 2017; Wang et al. 2016). The key point in approaching I4.0 is cyber-physical-systems (CPSs), which refer to a new generation of systems which consist of both a physical and integrated computational part (Letichevsky et al. 2017). The computational part is implemented by connecting the physical part to the cloud, which opens new possibilities for interaction with humans and other machines. Actually, this new way of interacting between different systems creates a so-called "system of systems", in which several CPSs are connected (Porter and Heppelmann 2014) and this enables new functionalities to optimize its operation.

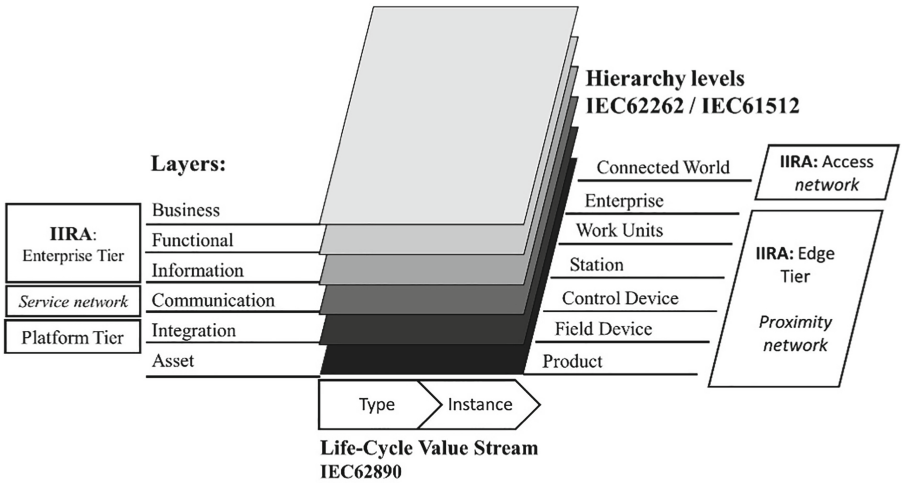

Fig. 1. Reference Architectural Model Industrie (RAMI 4.0) and the Industrial Internet Reference Architecture (IIRA).

Naturally, interoperability is mandatory in the system of systems in order to approach I4.0, otherwise individual systems and entities are in silos without the possibility of having shared functionalities. However, research and real industrial cases have shown that each solution tends to provide its own infrastructure without standardized interfaces, leading to an interoperability issue (Lelli 2019; Noura et al. 2019). Therefore, the current landscape is suffering from fragmentation with many proprietary platforms and vendors competing with their own solution (Sotres et al. 2019).

Two major standardization frameworks for industrial Internet architecture are the Reference Architectural Model Industrie (RAMI 4.0) and the Industrial Internet Reference Architecture (IIRA), which aim to extend industry interoperability through a high level of abstraction (Pedone and Mezgár 2018). Reference Architectural Model Industrie 4.0 provides features and patterns derived from the manufacturing domain and IIRA is more general and applicable in different domains. The two models are not precisely comparable, but both architecture models are presented in Fig. 1, which shows the corresponding features of both architectures.

3 Case Study

There is an ongoing research project called "Traffic 4.0" in the city of Hämeenlinna in Finland. The project aims to create new models for transportation that will be put into use later by the city. One pilot is the city bike system, which includes 14 bikes and three stations and has been in test operation since April 2019 until the spring of 2020.

The city bike system requires continuous operation and maintenance to ensure the usability of the bikes. In addition to the normal daily maintenance the bikes require, one example of a necessary operational task is balancing the bikes between different stations. Naturally, there are several other tasks, such as charging the batteries for the station and bikes, retrieving broken bikes, changing winter and summer tires, etc.

The city bike system consists of bikes, stations and the cloud part. All necessary data from the whole system are stored in the cloud, including important information about operation and maintenance tasks. Accordingly, we can state that the city bike system is a typical proprietary CPS, which together with other used technologies, creates the smart mobility system. Economical, efficient and effective operation and maintenance is required to integrate all CPSs to one platform.

Exploitation of the I4.0 paradigm to create an open interoperable ecosystem for the operation and maintenance of the smart mobility system requires the availability of adequate information across all technologies (i.e., system of systems), which is the result of the aggregation of data from various heterogeneous clouds, often under a real-time condition. This requires a digital platform for an efficient, secure and dependable information management infrastructure. On the other hand, solutions to ensure interoperability between the platform and technologies with a reasonable engineering cost are mandatory to ensure a sustainable ecosystem for efficient and high-quality operation and maintenance execution in the long run.

Next, we applied IIRA and RAMI 4.0 to create a standard-oriented open architecture for the smart mobility system presented in Fig. 2. According to IIRA, the smart mobility system consists of three tiers: an edge tier, platform tier and enterprise tier, and three functional domains: a proximity network, access network and service network. The edge tier is responsible for collecting data from vehicles through sensors and gateways using a proximity network and stores data to the vehicle's cloud storage through the access network. The platform tier is common to all different technologies used in the overall smart mobility system, which means that it receives, processes and forwards information between service providers in the ecosystem and vehicles in the field. The platform is therefore called a smart mobility platform (SMP) and it creates the necessary interoperability to create a sustainable ecosystem. The enterprise tier implements necessary applications and functionality for efficient and high-quality operation and maintenance, such as, e.g., task management for service field personnel and reporting to management. The service network enables a standardized interface on the SMP which is the basis for an ecosystem which is open and interoperable to service providers.

The concept of the different technologies used in smart mobility systems in RAMI 4.0 is presented in Fig. 2. The six layers of the vertical axis of RAMI 4.0 define the smart mobility system in the I4.0 context: business domain, functional and information application, communication and integration capability, and assets. The aggregation of data from one individual system is performed by the vehicle suppliers' proprietary

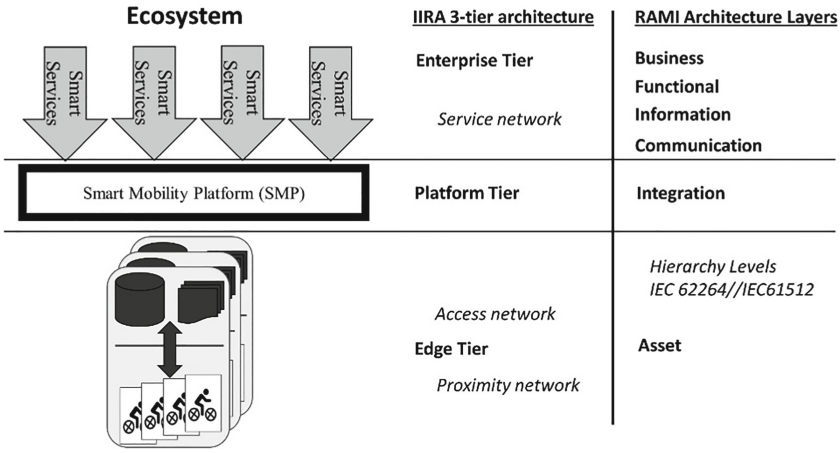

Fig. 2. Open ecosystem for smart mobility system operation and maintenance according to Reference Architectural Model Industrie (RAMI 4.0) and the Industrial Internet Reference Architecture (IIRA).

system and then data integration is performed by the SMP and it creates interoperability between service providers in the ecosystem and vehicles in the field. Standardized communication towards information, functional and business application, as created by the SMP, is necessary to create the open ecosystem for service providers. Information application provides the status of the vehicle fleet to service providers and its functional application is, e.g., task management. The business domain connects service operation to the enterprise resource planning (ERP) system which means, e.g., automatic invoicing to the customer according to agreed charges in Service Level Agreements (SLA).

4 Conclusion

An SMP is required to create an open ecosystem which is economical, efficient and effective with regard to the operation and maintenance of the smart mobility system. Currently, interoperability between the SMP and technologies used in smart mobility systems is challenging due to a lack of standardized interfaces. Therefore, further research and development is needed to standardize interfaces for operation and maintenance purposes, and this will enable open ecosystems for the different technologies used in smart mobility systems.

On the other side, the I4.0 reference architecture RAMI 4.0 and IIRA was applied to smart mobility systems and economical, efficient and effective operation and maintenance can be achieved by using smart services on top of the SMP.

There are several companies penetrating this new and fast-growing market. The service market is still very fragmented, and a dominant player is missing. As a conclusion, we can state that the player who can first create an SMP and solve the interoperability issue can be expected to achieve a leading position in the smart mobility operation and maintenance market.

References

Acquier, A., Carbone, V., Massé, D.: How to create value(s) in the sharing economy: business models, scalability, and sustainability. Technol. Innov. Manag. Rev. **9**(2) (2019). https://timreview.ca/article/1215

Benevolo, C., Dameri, R., D'Auria, B.: Smart mobility in smart city. Action taxonomy, ICT intensity and public benefits. In: Torre, T., Braccini, A., Spinelli, R. (eds.) Empowering Organizations. Enabling Platforms and Artefacts. Springer, New York (2016)

Docherty, I., Marsden, G., Anable, J.: The governance of smart mobility. Transp. Res. Part A: Policy Pract. **115**, 114–125 (2018)

Faber, A., Rehm, S.V., Hernandez-Mendez, A., Matthes, F.: Modeling and visualizing smart city mobility business ecosystems: insights from a case study. Inf. (Switzerland) **9**(11) (2018). https://doi.org/10.3390/info9110270

Grönlund, A., Svärdsten, F., Öhman, P.: Value for money and the rule of law: the (new) performance audit in Sweden. Int. J. Public Sector Manag. **24**(2), 107–121 (2011)

Hamari, J., Sjöklint, M., Ukkonen, A.: The sharing economy: why people participate in collaborative consumption. J. Assoc. Inf. Sci. Technol. **67**(9), 2047–2059 (2016)

Ji, S., Cherry, C.R., Han, L.D., Jordan, D.A.: Electric bike sharing: simulation of user demand and system availability. J. Clean. Prod. **85**, 250–257 (2014)

Jussila, J., Sillanpää, V., Lehtonen, T., Helander, N.: Value assessment of e-government service from municipality perspective. In: Proceedings of the 50th Hawaii International Conference on System Sciences (2017)

Lelli, F.: Interoperability of the time of Industry 4.0 and the Internet of Things. Future Internet **11**(2) (2019). https://doi.org/10.3390/fi11020036

Letichevsky, A.A., Letychevskyi, O.O., Skobelev, V.G., Volkov, V.A.: Cyber-physical systems. Cybern. Syst. Anal. **53**(6), 821–834 (2017)

Loidl, M., Witzmann-Müller, U., Zagel, B.: A spatial framework for planning station-based bike sharing systems. Eur. Transp. Res. Rev. **11**(1) (2019). https://doi.org/10.1186/s12544-019-0347-7

Midwinter, A.: Developing performance indicators for local government: the Scottish experience. Public Money Manag. **14**(2), 37–43 (1994)

Noura, M., Atiquzzaman, M., Gaedke, M.: Interoperability in internet of things: taxonomies and open challenges. Mob. Netw. Appl. **24**(3), 796–809 (2019)

Pedone, G., Mezgár, I.: Model similarity evidence and interoperability affinity in cloud-ready Industry 40 technologies. Comput. Ind. **100**(May), 278–286 (2018)

Porter, M.E., Heppelmann, J.E.: How smart, connected products are transforming competition. Harvard Bus. Rev. **11**, 64–98 (2014)

Pulkkinen, J., Jussila, J., Partanen, A., Trotskii, I., Laiho, A.: Smart mobility: services, platforms and ecosystems. Technol. Innov. Manag. Rev. **9**(9), 15–24 (2019)

Senyo, P.K., Liu, K., Effah, J.: Digital business ecosystem: literature review and a framework for future research. Int. J. Inf. Manag. **47**, 52–64 (2019)

Sotres, P., Lanza, J., Sánchez, L., Santana, J.R., López, C., et al.: Breaking vendors and city locks through a semantic-enabled global interoperable internet-of-things system: a smart parking case. Sensors (Switzerland) **19**(2) (2019). https://doi.org/10.3390/s19020229

Thoben, K.D., Wiesner, S.A., Wuest, T.: "Industrie 4.0" and smart manufacturing-a review of research issues and application examples. Int. J. Autom. Technol. **11**(1), 4–16 (2017)

Wang, S., Wan, J., Li, D., Zhang, C.: Implementing smart factory of Industrie 4.0: an outlook. Int. J. Distrib. Sens. Netw. (2016). https://doi.org/10.1155/2016/3159805

Yin, J., Qian, L., Shen, J.: From value co-creation to value co-destruction? The case of dockless bike sharing in China. Transp. Res. Part D: Transp. Environ. **71**, 169–185 (2019). https://doi.org/10.1016/j.trd.2018.12.004

5G as a Driver for Transition of Digitalization in Ecosystem-Based Development

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Abstract. Transition towards new ICT based technologies, as 5G- related technologies, will happen unexpected fast, including exponential growth of data. It is essential to understand the challenges of change and have a strategic view, identify the key elements and see the new opportunities in all levels of society development.

5G technologies are not fully standardized until during year 2020. Many key elements and benefits as increased latency, speed and reliability have been identified. It has not been too much discussion about the implementation on the technologies that are boosted by 5G. The development is very much depending on fiber network infrastructure investment.

Transdisciplinary innovation happens through digital innovation ecosystem to create profitable new business models. 5G do not replace other technologies but instead gives new possibilities for digital ecosystems to make new opportunities for business ecosystems to create new services.

There has been research about 5G possibilities in Smart city context in big cities, but not on what it provides in small cities. In this article is introduced the approach, how to prepare the 5G technology and the possibilities it may provide on Finnish growth corridor on city environment.

Keywords: Smart city ecosystem · Digitalization · Fiber network · 5G · Transdisciplinary innovation

1 Introduction

Smart cities offer the promise of safer, prosperous and more livable communities for all their citizens. To attain these benefits, smart city initiatives need a strong foundation: a high-performance network [1]. 5G could enable a new wave of technologies and applications, based on its novel infrastructure for smart cities, advanced manufacturing, healthcare systems and connected cars [2]. Industry is driven by a constant requirement for productivity. All means are sought to produce and deliver goods and services most efficiently. Growth in productivity is among the leading indicators of economic value and a strong measure of progress in the industrial age.

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Yet, in the last few decades, productivity growth has slowed dramatically. That has given the unprecedented advancements for information and communications technology. After all, we have witnessed massive innovation in the Internet era and the digital transformation of enterprises is well underway [3].

Now 5G technologies are just developing and becoming to wider use around the word. Even big 5G technology providers or operator are not able to give accurate prediction, how fast the development of 5G development will be. Nokia has in its predictions expected 5G technologies to be as fast and similar as LTE technologies development. Even if there is not a clear idea how fast the change will be or how it will happen there are no doubts that the change will be enormous. It is important to understand how cities and industries should be prepared for that change.

5G does not replace old technologies but gives new opportunities for new technologies. 5G may also boost the use of old technologies. There will also be solutions for which 5G does not provide anything beneficial. It is important to create benefit of 5G, not only for big cities, but also in countryside and small villages. It is predicted that the 5G technology will be utilized first in industry. In other sectors, 5G networks are becoming more common as the benefits and applications of 5G in different sectors become more concrete. As a rule, 5G has been designed for a much more versatile use than the previous GSM generations. It is challenging to identify uses for which 5G is not suitable [4].

On the discussion about 5G, the question is not about the technology itself, but how to manage the change so that it will be beneficial for whole society on sustainable way. It is important to achieve an excellent digital human user experience by implementing 5G- technologies.

2 Theoretical Framework

Major global challenges, such as globalization, climate change and digitalization. are influencing on societies, cities and regions as well as on industries. Today, 55% of the world's population lives in urban areas, a proportion that is expected to increase to 68% by 2050 [5].

The key features of 5G are high capacity, low latency, and the ability to connect a massive number of IoT sensors to the network. In addition, compared with the previous network generations, the 5G network makes it possible to implement tailored web services for different needs.

It is becoming clear that 5G will cost much more to deploy than previous mobile technologies (perhaps three times as much), as it is more complex and requires a denser coverage of base stations to provide the expected capacity. The European Commission has estimated that it will cost €500 billion to meet its 2025 connectivity targets, which includes 5G coverage in all urban areas [6].

5G is driven by the telecom supply industry and its long tail of component manufacturers. Their major campaign is under way to convince governments that the economy and jobs will be strongly stimulated by 5G deployment. However, we have not yet seen significant "demand-pull" that could assure sales. These campaign efforts are also aimed at the MNOs but they have limited capacity to invest in the new technology and infrastructure as their returns from investment in 3G and 4G are still being recouped [6].

The capacity of 5G network serves exponentially accelerating growth of data. Low latency, in turn, is important in many different sectors. An example is AI applications, which must be able to react to different situations in real time, for example in industrial processes. Latency is also of high importance in the remote control of self-directed vehicles and other machines and equipment. 5G is therefore not only a network faster than the previous generations but a technology that makes it possible to put many digital innovations into practical use.

Now things are changing, when industries in the "physical economy" have begun their digital transformation. It is possible to recognize the opportunity for much bigger productivity boom. Now the Internet of Things (IoT), edge computing, deep analytics based on artificial intelligence/machine learning (AI/ML), augmented reality (AR), robotics, remote control and digital twin technologies are mature enough and can reach a critical mass of adoption, the opportunities to energize traditional industries are countless.

Advances in robotics have begun to dramatically simplify the interface between digital systems and physical tasks. Technologies that can bring the physical and digital economies together will drive commercial and social value better than before. Augmented intelligence and automation will drive productivity while dramatically reducing risks [7].

The strength of the international GSM ecosystem has always been agreeing on international standards and sticking to them. From industrial point of view, it is important to ensure that this will continue. Global compatibility is an absolute prerequisite for the exploitation of technology, and it is also a common interest for all the industries. In this sense, the 5G network will be built in the same way as the previous network generations. Holma and Poikselkä [8] have introduced an overview of the different 5G architectures and then cover in more details the radio access network (RAN) architecture and interfaces as well as the 5G Core (5GC) network with key elements and functionalities.

Operators network is an ecosystem where companies and organizations together develop 5G uses. The network gives you the possibility to share knowledge and create innovations with players of different industries, and the members include companies, public sector organizations and startups. The members of the network will be among the first to take advantage of the opportunities offered by 5G and of related information [4]. The future 5G transport networks are envisioned to support a variety of vertical services through network slicing and efficient orchestration over multiple administrative domains [9].

The move to Industry 4.0 and the ongoing transformation of enterprises to adopt cloud, IoT and advanced wireless networking options is a massive undertaking [10]. It will demand strong partnerships with industry, and ecosystems that are at once more diverse and more cohesive than we have ever seen before. As such, Nokia is actively engaged in catalyzing, developing and joining the ecosystems and consortia that will drive specific industries to accelerated benefits [1].

3 Research Approach

5G - The smart city concept integrates the information and communication technology (ICT), physical Internet of things, and IoT-devices to optimize the efficiency of city operations and services [11].

5G and other new technologies and huge amount of data forces also organizations to change. That is the reason why many cities are developing their activities towards smart city concept and taking use to 5G technologies by having ecosystem-based development.

Research questions of this study are:

1. How 5G- technology is influencing on holistic development of society activities?
2. How is ecosystem-based innovation, learning and business transition occurring?
3. How 5G- technology is reacting on various ecosystem development layers?
4. How is digital and human user experience achieved when implementing 5G-technologies

In this study has been used qualitative and case study research approach. This article introduces 5G development in smart cities - new concept for small towns in 5G framework. It provides a case study as a part of Hämeenlinna city ecosystem- based development.

4 5G Ecosystem-Based Development in Small City and Smart Countryside Environment

Global demographics are rapidly changing. According to the latest United Nations report, more than two-thirds of the world's population will be living in urban areas by 2050. In addition, a World Economic Forum article states that, for the first time in human history, there are now more people over the age of 65 than under the age of 5. A confluence of these inexorable trends of urbanization and population change put immense strains on city infrastructure and services and has triggered the concept of the smart city for a safer, more sustainable and livable community. Consequently, cities are embracing innovative smart city applications to automate and optimize the operation of their underlying infrastructure and services, from street lighting and CCTV to air-quality sensors, traffic management and emergency services. By improving the performance of infrastructure and services, smart cities also improve citizens' quality of life and foster higher economic growth.

New innovations are based on increasing amount of data, use of new technologies and understanding of new needs of customers. That is the reason there is need for "real life" testing, piloting and developing environment. Including this, ecosystem-based development work is needed when the environment is fast changing and complex.

The utilization of 5G has started and it has expected to bring new business opportunities and the development for new business models. Anyhow there is need to remember that 5G technology is just technology for data transfer, which need a fiber network and broad stations to support it. We can consider the 5G as an infrastructure or a fundament for the utilization of 4IR technologies.

The harmonization of data and standardization of new technologies will give the possibilities for developing new digital ecosystems. It will give fundament and new possibilities, when benefitting 5G, for new innovations and business models. When taking 5G into use, it is important to see the development action of 5G on different each other's interacting ecosystem layers.

Different layers of ecosystems on 5G development are described in the Fig. 1. They will give the frameworks and vision for development.

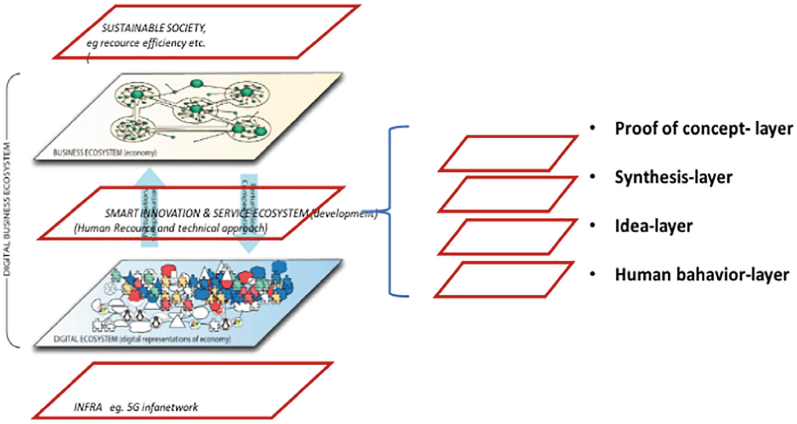

Fig. 1. Different layers of smart city development- 5G as fundament of development

The meaning of various layers and related ecosystems are descripted as following:

Infrastructure-layer is fundament for 5G, which provides infrastructure for fast data transfer. The fiber network and broad base stations form this infrastructure. The availability of fiber network and the density of stations will provide the possibilities for the region. The existence and the reliability are the fundament for all development.

On **Digital ecosystem-layer** the key issue is the standardization of technology and harmonization of data, so that data can be used in the best possible way.

Innovation layer is for the development of a new innovation and implementing possibilities. Innovation process on this layer is divided into four sections, which are: a. human behavior, b idea, c. synthesis, d. proof of concept (POC).

On **Business ecosystem layer** new business and new business models will take place and new startups take birth. The core purpose on business ecosystem is to create profitable business.

In this article the purpose of **Sustainable ecosystems layer** is in decision making process. It will give impact on the actions that is expected. This kind of actions are eg. land use planning, building fiber network, open data, taxation, regulations etc., which are supporting the attractiveness of a region.

5 Innovation Process

Since the change will be fast and complex, development work has to happen in a "real life" environment. As well, it is impossible to determine all the possible options. Thus, the quick pilots in real life environments are essentials for development (Fig. 2).

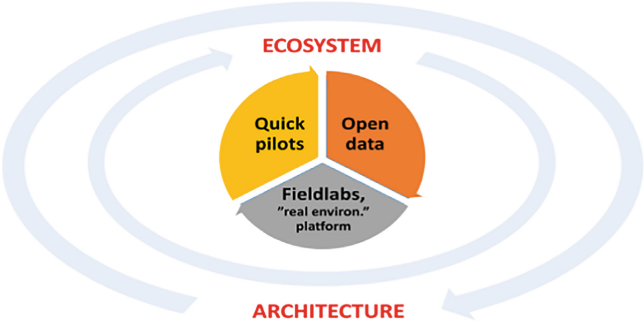

Fig. 2. The birth of innovation in digital ecosystem

Ruohomaa and Salminen [12] have introduced a model for ecosystem-based development using open data and quick pilots in real live environments. In this framework the role of new innovations and innovation process is very important, because it is a key issue on transition process in the environment of new technologies.

6 The Pillars of Hämeenlinna Development

Hämeenlinna town is located on the Growth Corridor of Finland. The main part of population, and economic activities in Finland are located on Finnish growth corridor. The key goal for Hämeenlinna town is to increase its attractiveness, imago and improve the competitiveness of the town, Because of these reasons Hämeenlinna is in its own development work and strategy focusing on:

1) ecosystem-based development
2) open data environment
3) "Railway station environment" part of city as a piloting environment as fieldlab
4) quick pilots

In order to response the development need of 5G, Hämeenlinna town is executing economy system-based development with the elements of Smart city concept. New 4RI technologies do not replace old technologies very fast, but the use of present technologies will supplement more and improve. That's why 5G should be seen as technology which improves and boosts development.

When new and present technology and increasing amount of data have been brought on the same platform, it will be possible to see the problems in solving and making improvements in interoperability and identify lack of standardization.

Ruohomaa and Salminen [12] have introduced that ecosystem based city development needs innovation platform (Fig. 3). Building blocks are a common platform, common technology, common architecture, sharing data and also common goal. Innovations are created on the interfaces of various partners from different domains.

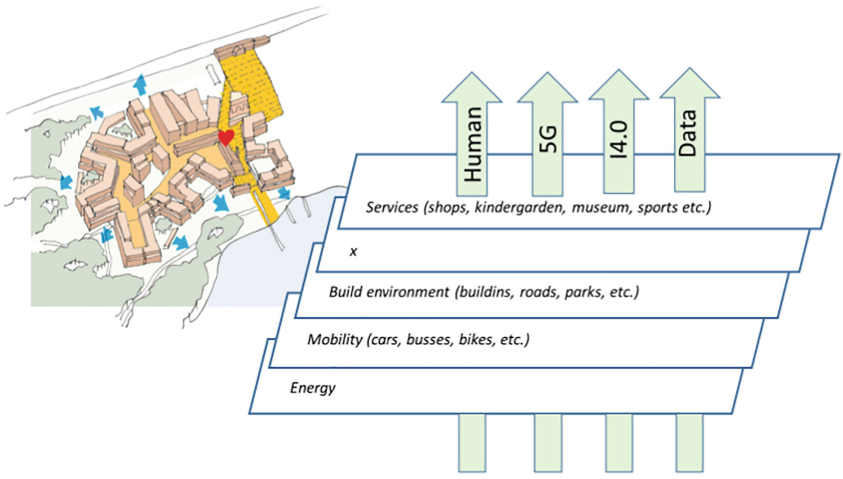

Fig. 3. Ecosystem based innovation platform

Smart City development can also be shown as the way that 5G infrastructure has to be present in the all different activities/operation of city level. Harmonization of data and the availability of open data are essential on development work.

5G technology is important for applications. Artificial intelligence, robots, self-directed vehicles or applications with remotely controlled devices are required to react to different situations without delay and in real time. For example, when two AI applications communicate with each other, it is necessary to have fast and latency-free data transfer. The AI application must also be able to react to different situations in real time. If artificial intelligence analyses video or other footage, it should be of high quality. This will require a high data transmission capacity.

Latency is a significant factor in remote controlled devices. A device or machine must be able to react to remotely given commands in almost real time. The same applies to self-directed vehicles. In the event of a problem, for example, it must be possible to intervene in the driving in real time.

Self-directed vehicles will also collect a lot of data on their environment. 5G network capacity is required, when data is to be transferred to data center for analysis [4].

The **Future X architecture** [1] harnesses technologies such as Industrial Internet of Things, edge computing, cloud, artificial intelligence, machine learning, augmented and virtual reality, and high-performance networking - including 5G - to drive dramatic productivity improvements across a wide range of industrial sectors.

With the **Future X for Smart Cities architecture**, you can enable the human possibilities of smart cities by interconnecting your systems, processes, activities and citizens. The opportunities and benefits are:

- Ease the flow of cars and people with smart mobility services. Simplify bus connections. Offer a real-time view of available parking. Monitor crowds in public venues.
- Use energy resources more efficiently in homes and businesses, as well as for public lighting.
- Enhance public safety with video-surveillance analytics, an integrated command and control center, and enhanced communications for first responders.
- Improve healthcare in your city with remote monitoring applications, while keeping costs under control.
- Enhance the fun and safety of large events and improve the tourist experience.

7 Conclusions

5G is for sure the key element for the development of the technologies in the fourth industrial revolution. The key issue is fiber network and stations, which could be seen as the infrastructure of digital communication. Especially the availability on fiber network in rural areas is the key issue to have reasonable environment for development of 5G based activities.

Since the speed of digital transition is fast, it is important to have a clear vision, which gives direction for development, since the new technologies are continuously developing. There is neither clear understanding about the outcome nor the new business models which will take place in future.

Since the new technologies have strong focus on inter-compatibility, it is essential that there will be ecosystem-based development. It will make complex and fast changing world development activities possible. It is also essential to have "real life" testing, piloting and learning environment.

Industry 4.0 technologies are developing, but they are not completely ready yet. So old technologies will be usable for a long time. Change will not happen "overnight", even if the change is fast. Many of the new technologies are working already in a reasonable way on 4G connection, so these technologies should be actively studies.

References

1. Nokia 2019/1: Laying the foundation of a smart city. https://onestore.nokia.com/asset/206572
2. Nokia 2019/2: Nokia Bell Labs Future X for Smart Cities architecture. https://www.nokia.com/networks/industries/smart-city/
3. Nokia 2019/3: White paper. https://www.nokia.com/blog/meet-1000-year-old-city-futurewroclaw-poland-taking-smart-city-new-level/
4. Telia 2019 what are 5G questions and answers. https://www.telia.fi/en/yrityksille/article/5g-questions-and-answers
5. United Nations, 15 May 2018. https://www.un.org/development/desa/en/news/population/2018-revision-of-world-urbanization-prospects.html
6. Blackman, C., Forge, S.: 5G Deployment: State of Play in Europe, USA and Asia, Study for the Committee on Industry, Research and Energy, Policy Department for Economic, Scientific and Quality of Life Policies, European Parliament, Luxembourg (2019)
7. Networking solutions for the new age of industry. https://onestore.nokia.com/asset/2057091

8. Holma, H., Poikselkä, M.: 5G Architecture. 5G Technology: 3GPP New Radio. Book edited by Holma, H., Toskala, A., Nakamura, T. Wiley, December 2019. Print ISBN 9781119236313
9. Antevski, K., Perez, J., Molner, N., Gharbaoui, M.: Resource orchestration of 5G transport networks for vertical industries. In: Conference: 2018 IEEE 29th Annual International Symposium on Personal, Indoor and Mobile Radio Communications (PIMRC), September 2018
10. IoT Community (2019). http://iotcommunity.com/the-program/
11. Peris-Ortiz, M., Bennett, D., Yábar, D.P.-B.: Sustainable Smart Cities: Creating Spaces for Technological, Social and Business Development. Springer, Cham (2016). ISBN 9783319408958
12. Ruohomaa, H., Salminen, V.: Mobility as a service in smart cities – new consept for smart mobility in Industry 4.0 framework. ISPIM Connects Ottawa, Ottawa, Canada, 7–10 April 2019. The publication is available to ISPIM members (2019). www.ispim.org

Ecosystem of Ecosystems in InterCity Biking

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Abstract. Digitalization, megatrends, the new opportunities offered by technologies have caused societies to break through towards the fourth industrial transformation. It will change the whole society and its structures alongside the business. All societies, not just corporations, but also cities and regions, have to prepare for the change caused by digitalization. That challenges also traditional organizational structures. This requires a new type of business operation and organization.

Cities are responding to the rapid progress of society and are moving from traditional organizational structures to ecosystem development. They are building their own network to involve in developing new operations. While cities largely receive their own funding as taxes, development and change management must be considered in the same way as in businesses. A key measure of efficiency is the improved service and achieved cost efficiency. The article examines the city biking ecosystem development on the Finnish Growth Corridor.

Keywords: Ecosystems · Biking · Management of change · Smart city

1 Introduction

Public transport authorities are increasingly looking to embrace innovative technology to meet user expectations and enable travelers to personalize their journeys [1]. In the transport sector, ensuring the effectiveness of the market is highly topical. Transport services are meant to be converted into a service package along the lines of the communications service sector. In the future various transport service chains should work seamlessly together [2].

InterCity biking in this context means that when citizen is moving from a town to other the citizen can use bikes in both towns, even if the trip between towns itself will be taken with bus or train. City bikes are often strategic aligning for cities to improve the flexibility of traffic and improve the image of the city. City bikes have also been marketed as a non-polluting solution.

In order to increase intercity cycling, and related mobility between various cities, it must be considered the whole ecosystem around cycling. It may as well include the coordination of a single intercity cycling system or co-operation between separate systems.

The main goal of intercity bike systems is to improve the image of the city, to increase its attractiveness and to build flexible travel chains as part of the development

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of public transport. It is the objective to move car traffic from the city centers. The proliferation of bike systems requires that their utilization rate is high enough. It indicates then profitability and necessity (customer satisfaction).

Data collected (or the ability to collect) from city bikes is still fragmented and sometimes not used at all. In general, it is observed that data acquisition is largely neglected in the procurement of city bikes.

In this article is introduced a case study of mobility (bike) as the very first step towards ecosystem-based intercity biking fleet development in Finnish Growth Corridor.

2 Theoretical Background

The smart city concept integrates the information and communication technology (ICT), physical Internet of things, and IoT-devices to optimize the efficiency of city operations and services [3]. Transportation is an important part of the concept of smart cities, and the main goal is to ensure safe and effective mobility of individuals and goods in a way that minimizes the CO^2 emissions. Thus, transportation should not be viewed as simple "moving people and goods from one place to another" [4]. propose, that transportation should be understood as a service, in which timely delivery of people and goods in target destination is emphasized.

Mobility-as-a-Service (MaaS) describes a shift away from personally-owned modes of transportation towards mobility service solutions. In the MaaS distribution model, the customer's major needs for transportation are met from a single platform, in which the services are bundled into monthly packages. Overall, MaaS depends on viewing the provision of transport as a co-operative, interconnected ecosystem, providing cost-effective services that are personalized to meet customer needs [5].

The Internet has transformed the world economic landscape, and this transformation is expected to continue with the Internet of things (IoT). Rifkin [6] confirms this trend in his concept of zero marginal cost, which emphasizes connectivity in his anticipation of a collaborative economy that will replace the capital system in its current form – with the IoT as the main driver. The rapid progress of smart cities is also paving the way to a more collaborative world [7].

Appearance of city bikes are changing our understanding about biking. City bikes are moving biking to towards biking as a service. City bikes are boosted also with utilization of digital platforms.

When we design city bike system, it can be seen as a part of business ecosystem, which are interfacing digital ecosystems. Thus, bikes are part of transport/mobility ecosystems and also part of mobility digital ecosystems. City biking is also reflecting to the change in environment (e.g. weather, traffic arrangements, etc.).

Connecting biking data to some other data sources, in order to create new services or start-ups, might support the growth of biking.

Through digital transformation, the use of new technologies like big data, open data, cloud, IoT, platforms, artificial intelligence, and social networks with increasing intelligence and automation enterprises can capitalize on new opportunities and optimize existing operations to achieve significant business improvement [8].

The smart city concept integrates the information and communication technology (ICT), physical Internet of things, and IoT-devices to optimize the efficiency of city operations and services [3]. New technologies and huge amount of data forces also organizations to change.

3 Research Questions

The aim of this study is to introduce digital ecosystem for InterCity based city biking at Finnish Growth Corridor.

The main topics of discussion are:

1. How the intercity biking chain is formed?
2. What type of shared data architecture should be built for intercity biking?
3. What are the key elements of digital ecosystem on intercity biking?
4. What are the motivation factors to follow the human ecosystem-based development and business transition?

4 Digital and Business Ecosystems

Bikes as vehicles are the part of bigger transport ecosystems. Bikes are a part of daily life of the people/transportation. Bikes are also part of transport mobility planning of city. Digitalization gives new possibilities to develop new digital ecosystems around biking and thus create new services to support it (Fig. 1).

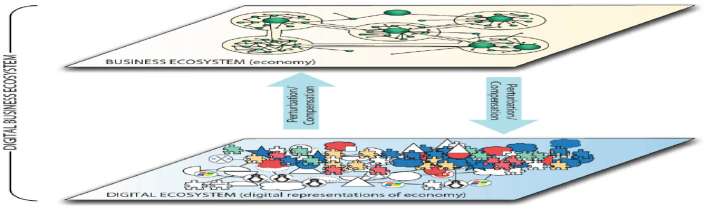

Fig. 1. Digital ecosystem and business ecosystem will be connected in order to create flexible services.

Growth of connections brings the new possibilities and solutions for business. Exponential growth brings also new challenges for education, R&D&I and regional development activities. The exponential growth of IoT connections indicates the birth of new business models and new kind of business environments [9]. This "smartness" requires greater connection and collaborations. This is where the 'explosion' of platforms and ecosystems is occurring. To attempt to connect the internets of things, services, data, and people need radical redesigns within industries and the participants to connect everything. Presently Industry 4.0 is more industrial driven, but this will change and broaden out [10].

It is the technology that will enable the business ecosystem strategy now and in the future. Success will require a strategic integration of technology, information and business processes.

Technology architecture should be agreed upon. Municipalities should create an open architecture that private partners can integrate to, but that should meet the needs of their citizens [11]. The problem of traffic/mobility development is not technology but primarily governance [12].

Every organization exists in multiple business ecosystems. These business ecosystems are dynamic networks of entities interacting with each other to create and exchange sustainable value for participants. The challenge is deciding how your organization will survive and thrive in its ecosystem [13].

The degree of openness within ecosystems is driven by strategies, common goals and shared interest. An ecosystem may be public, private or a hybrid. Many organizations actually participate in a hybrid of public and private ecosystems.

The openness of an ecosystem has two implications. The degree of change is dependent upon the possibility of new entrants and disruption to relationships and value. It will also define the nature of the relationships in the ecosystems and how they are formed and maintained. It will define the nature of collaboration and competitions [13].

Bike share ridership fluctuates based on external factors such as weather, events, and holidays, and Nutley said that redistribution of bicycles in response to those factors is 40–60% of the operations costs of running a bike share scheme. The need to keep bikes repaired and serviced is also a challenge, yet simply adding more bikes is not the solution. In reality this does little to increase efficiency and often adds to the problem [14]. Most important on all viewpoints is to understand the digital human- oriented experience in the development of intercity biking system.

5 Biking Ecosystem as the Ecosystem of Ecosystem

Rather than being seen just as a fun alternative, bike share operators and the cities, where they operate, want bike share travel to be a viable part of the transportation system for city residents. “For bike share schemes to be seen as a real public transport solution and a smart answer to urban mobility, they need to work as good or better than existing public transport services,” said Paul Stratta [14].

Each city is different, with hundreds of different parameters, such as the amount of public transport available, the number of train and bus stations, the weather, the topography [14].

Towns on Finnish growth corridor have systematically developed biking ecosystem based on the strategy about open data utilization and development work.

Piloting study which took place in 2019 and some other experiences in Finland shows that the capacity utilization of bikes in depending on:

- How city bike system is connected to the rest of public transport systems (timetables, payment systems, etc.) and MaaS (mobility as a service). This indicates efficiency of mobility chain.
- Bike operators’ maintenance system is able to keep its service level agreement (SLA)

- Environment maintenance system to support the biking infrastructure (e.g. biking roads, winter maintenance etc.
- Online information sharing for customer/bikers, e.g. availability of bikes on a station, winter maintenance information (which) road are open from snow for biking, general data about collected information which is relevant for biker.
- Data for decision making., e.g. BI-analysis (data which can be used to improve customer satisfaction and performance indicators and foresee the changes for need of bikes e.g. change of season, end of tourist season, happenings, weather, etc.
- Personalized value-added services for biker, which are based on the open data provided by city bike system. (e.g. biking as part of daily health care and exercise) (Fig. 2).

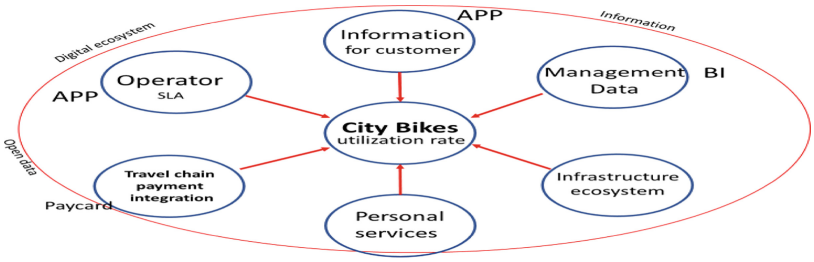

Fig. 2. The framework for City bike ecosystem at Finnish Growth Corridor cities

The biking systems in small towns are most of cases a part of the flexible mobility system. The city bike systems are usually financially supported by towns by taxpayer moneys. So, it would be wise to open the data for public use to start to develop new start-ups or new services for bikers.

By offering open data for biking, it is possible to create new services and support the growth of biking.

6 Developing Intercity Biking System for Smoot Attractive Mobility

Most of cases the cities are doing their decision about city bikes in order to improve local mobility or increase satisfaction of citizens.

On Finnish Growth Corridor these towns are marketing their locations and city as a good environment to have home or good place to work. One of the key issues is that there is railway station and good connection from and to Helsinki. Anyhow there has not been too much discussion about the “last mile” mobility in both ends (Fig. 3).

Towns are different and they have different needs and interest, but they have also common interests, which could bring value for all without extra expenses. If towns on Finnish Growth Corridor could be willing to adapt similar kind of data format and share the information for public use, there would be possible to create Growth Corridor standardized approach how city bike systems are connected to together.

This would provide:

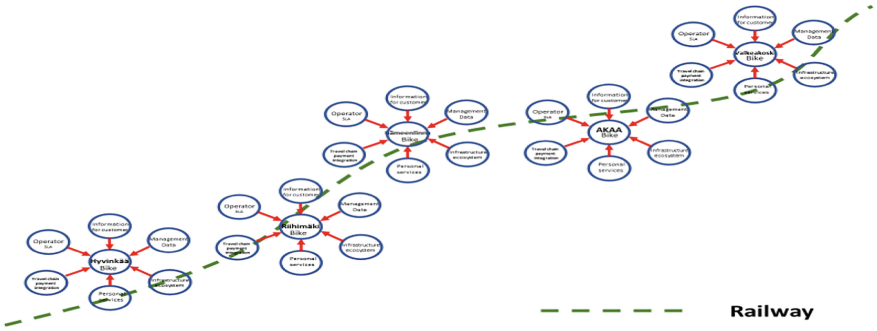

Fig. 3. Last mile of mobility chain in towns and ecosystems on the growth corridor.

- more flexible travelling chains
- better customer service
- better capability to reach the environment friendly mobility
- better capacity utilization of city bike systems
- less expenses
- collected data on growth corridor provides new opportunities for innovation.

In order to have these benefits the towns and municipalities should agree main principles about standardization of data ownership of data and the sharing the data, for new innovations.

The bikes are usually purchased or rented from operators which provides bikes as a service. These operators have also their payment systems and as well, they have their way to collect the data.

There is a lot of discussion of having common bike system for whole growth corridor, but various towns should make choices about bike systems together and with agreed rules.

To agree this kind of standard approach would not increase the expenses for towns nor for suppliers but would provide great opportunities to use data and create larger corridor wide competences and over all bike system efficiency and capacity utilization.

As well, open data, and standardized system would provide fundament for new services and new startups on towns on Growth Corridor.

7 Discussion and Conclusions

City bike systems are coming more and more popular in bigger cities and can provide pollution free and flexible way to move from place to another. Anyhow there has not been much discussion about the ecosystems around city biking in rather small cities or intercity travelling by using bikes.

In the center of whole the intercity biking ecosystem and capacity utilization is the digital human- oriented experience.

To develop attractive biking concept for most of the towns on Finnish growth corridor town, there is need to have common understanding about the rules and the key indicators, To shape common vision about bike system can easily considered to be quite

complicated, since every town has its own interest, own goals, own transportation system, own topology, own roads etc. own decision make process. Thus, is quite difficult to find one and only solution which would fit for every city best possible way and response future needs.

So, there is justified argument that towns should be able to manage their transportation based on their own understanding and interest.

On the other hand, all city bike systems will send quite a lot data that could be used for decision making on town level. If this data would be combined to the data of other town, that would give wider understanding for decision making on Finnish Growth Corridor.

There is also common interest to use all possible element to improve the capacity utilization of city bikes because it would increase the supply of city bikes and lead to harmonization of data in every towns' own ecosystem.

The needs of bikes are depending from many factors and as well common profitability. This kind of factors are seasons, happenings, weather, etc. That is the reason why data should be collected on the all towns on growth corridor.

As a conclusion, city bike systems should be designed based on town's own need, but the use of data should be harmonized also for payment systems. Anyhow it is very important to notice that decision for data harmonization has been done before the decision about biking system supplier has decided.

References

1. Racontour. MaaS: Changing the way you travel, 11 September 2018. https://www.raconteur.net/technology/maas-changing-travel
2. LVM Ministry of transportation and communication (2019). https://www.lvm.fi/en/services
3. Peris-Ortiz, M., Bennett, D.R., Yábar, D.P.-B.: Sustainable Smart Cities: Creating Spaces for Technological, Social and Business Development. Springer, Cham (2016). ISBN 9783319408958
4. Wensveen, J.G.: Air Transportation: A Management Perspective. Ashgate Publishing, Ltd. (2015)
5. ITS Finland (2019). http://www.its-finland.fi/index.php/en/palvelut/mobility-as-a-service.html
6. Rifkin, J.: The Zero Marginal Cost Society: The Internet of Things, the Collaborative Commons, and the Eclipse of Capitalism. St. Martin's Press, New York (2014)
7. Moss Kanter, R., Litow, S.S.: Informed and Interconnected: A Manifesto for Smarter Cities. Harvard Business School Working Paper 09-141. Harvard Business School, Boston (2009)
8. Salminen, V., Kantola, J., Ruohomaa, H.: Digitalization and big data supporting responsible business co-evolution. In: 2nd International Co-evolute Conference on Human Factors, Business Management and Society (Inside AHFE 2016), Orlando, USA, 27–31 July 2016 (2016)
9. Deloitte: Industry 4.0 challenge: Challenges and solutions for the digital transformation and use of exponential technologies (2015)
10. PwC: 4.0 Industry: Building the digital enterprise. Global Industry Survey (2016)
11. Deloitte Review: The rise of mobility as a service, issue 20 (2017). https://www2.deloitte.com/content/dam/Deloitte/nl/Documents/consumer-business/deloitte-nl-cb-ths-rise-of-mobility-as-a-service.pdf

12. Ruohomaa, H., Salminen, V.: Mobility as a service in small cities – new concept for smart mobility in Industry 4.0 framework. In: ISPIM Connects, Ottawa, Innovation for Local and Global Impact, 7–10 April 2019 (2019)
13. Panetta, K.: Eight Dimensions of Business Ecosystems. Gartner, 12 July 2017. https://www.gartner.com/smarterwithgartner/8-dimensions-of-business-ecosystems/
14. Dennis, A.L.: Case Study: Artificial Intelligence Helps Bike Share Programs Get Smart, 14 June 2018. https://www.dataversity.net/case-study-bike-share-programs-get-smart-artificial-intelligence/?fbclid=IwAR3adaqrjlFnRlnmKTEVd7XSEsVwe0nytLWLZI4L97OgRmX8_pAowDrTK9

Collaboration Network Creation and Utilization in a Digital Bioeconomy Ecosystem

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Abstract. Networked collaboration between industry, research institutes, the public sector and consumers forms an ecosystem for the development of new technological solutions for areas requiring multidisciplinary knowledge and capabilities. The goal of this paper is to present the "Bioeconomy 4.0" research and development ecosystem for developing digital solutions for monitoring, analyzing and interpreting data collected from bioeconomical processes. The ecosystem includes research and development institutions and activities, academic institutions, industrial actors from food production chains, the public sector and also consumers. The main focus of the paper lies in the creation and deployment of new multidisciplinary knowledge in networked collaboration between ecosystem stakeholders.

Keywords: Knowledge creation · Ecosystem · Bioeconomy · Collaboration networks

1 Introduction

Development of the internet of things (IoT) has made it possible for digital devices and sensors to produce huge amounts of measurement data that have great potential in terms of developing and optimizing processes related to production chains, processes or service production. In economies based on natural resources, digitalization development enabled by the fourth industrial revolution and "Industry 4.0" technology framework [1] provides opportunities for smart- and resource-wise production of bio-based products. For example, in urban areas, digitally controlled and optimized multilayer plant production provides alternatives to traditional greenhouse production. Cultivation in closed, controlled environments not only provides consumers with local food but also valuable additives such as pharmaceutical products and energy. In the same manner, smart solutions for digital bioeconomy may be applied to other food production chains such as milk production.

However, to fully utilize the digitalization potential in food production, effective methods for collecting, analyzing and interpreting data are required. This is because understanding, monitoring, optimization and development of smart food production

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requires effective methods for utilization of data. As data are typically collected and analyzed throughout value chains from initial production to consumers, multiple industrial and commercial stakeholders are involved. On the other hand, research and development work extends beyond the food industry since methods and technologies for bio-based data utilization are being widely developed in research institutes such as universities. In this manner, networked collaboration between industry, research institutes, the public sector and consumers forms an ecosystem for the development and deployment of new approaches to digital bioeconomy.

Following the general principles of the Industry 4.0 framework, this paper presents the Bioeconomy 4.0 research framework, which includes research and development institutions and activities, academic institutions, industrial actors from food production chains, the public sector and also consumers. The purpose of the framework is not only to utilize existing digital tools and technologies within the context of bioeconomy but also to create new field-lab-based research and development environments in which the data collected from the processes of bioeconomy are used to monitor, analyze and optimize these processes. In this manner, the strategic goal of the Bioeconomy 4.0 ecosystem is to utilize the potential of the fourth industrial revolution (digitalization, IoT and data utilization) in bioprocesses. The benefits for society and, in particular, the production chains of bioprocesses (food, fuels, medicines and other bio-based products) are thus the main focal areas.

In this paper, we focus on the building process for the ecosystem and describe how different network actors collaborate and jointly create industrial and academic value in the field of digitalized bioeconomy. The scientific framework of the paper relies on collaboration network creation and development from the viewpoint of interorganizational learning and new knowledge creation. In parallel with its scientific contribution, the paper presents practical approaches to ecosystem-based collaboration between heterogeneous actors working towards mutually agreed targets and goals. In this manner, practical outcomes of the ecosystem work include creation of new knowledge, processes, analysis tools and techniques, as well as application methods in a new area with huge practical potential. As the development work is to be carried out in close collaboration with a network of industrial and research partners, the outcomes are directly applicable in practice. The paper also describes how ecosystem actors jointly execute piloting and testing of the newly developed tools, technologies and processes in real-life contexts in field-lab environments.

2 Knowledge Creation in Collaboration Networks

It is now widely recognized that collaboration crossing organizational boundaries is crucial for research and development (see, e.g., [2]). In this manner, industrial firms today strive to acquire valuable new knowledge, competences and capabilities from outside firms' boundaries [3–5]. Thus, in the spirit of the open innovation paradigm [6, 7], firms have actively started opening their doors to collaboration with network partners who could potentially help them create valuable new knowledge or competences. This is particularly true in knowledge-intensive industrial areas that deal with complex problems requiring expertise from several professional or scientific disciplines [8].

In parallel with interfirm relationships, collaborative networks consisting of industrial actors and research institutes have often achieved successful results in transferring and developing new multidisciplinary knowledge [9]. In this manner, knowledge co-creation between industry and research institutes is essential not only to utilize externally available knowledge resources (such as research staff and research infrastructure) but also to absorb and utilize research-based scientific knowledge [10]. Thus, networked collaboration between industry and research institutes not only combines heterogeneous actors but also heterogeneous knowledge possessed by these partners [11].

Digital solutions for solving problems in complex bioeconomy processes typically require multidisciplinary understanding that is difficult to find from one actor. For this reason, R&D in this area increasingly relies on networked collaboration between research institutes, industry and public sector actors. These collaboration networks are typically built on knowledge-intensive relationships in which knowledge resources are transferred, developed and created between the partners. Knowledge resources developed through collaborative relationships are typically tacit, context specific and dispersed [12, p. 1194]. As tacit knowledge is based on experience, it is difficult to codify into a form that is easy to access or utilize. When the knowledge is context specific, it may be of little use outside the relatively narrow context for which it was developed. Knowledge dispersion, on the other hand, refers to the extent to which knowledge is concentrated in the heads of individuals rather than the minds of many, which, in turn, affects the transferability of this kind of system-embedded knowledge.

The Bioeconomy 4.0 framework (primarily developed at Häme University of Applied Sciences, Finland) focuses on data-based analysis, monitoring and management of food production chains. The Bioeconomy 4.0 program follows the principles of the Industry 4.0 framework by answering to the emerging challenges and great but underutilized potential of bioeconomy by means of digitalization and IoT-based solutions. In parallel with the research activities, the program aims to develop international collaboration networks to facilitate effective learning and knowledge-creation networks with industrial and academic partners as well as public sector actors. In this paper, the concept of network creation and utilization is described.

3 Collaboration Network Creation and Utilization in the Bioeconomy 4.0 Framework

This section introduces a model for creating and utilizing multidisciplinary collaboration networks within the Bioeconomy 4.0 framework. The development work started in 2019 at Häme University of Applied Sciences, Finland, and it is due to be finalized in 2021. One of the main goals of the framework is to create a collaboration network to facilitate development of new approaches to digital bioeconomy by means of combining understanding of digitalization, IoT and data analysis with knowledge of bioeconomical processes. For this reason, the research and development network needed to utilize scientific and practical competences not only in the area of bioeconomy but also data collection, analysis, interpretation and utilization. Figure 1 presents the central idea of the research and development work executed within the framework. The focus areas of the research (in this case, bioeconomy-based research topics) have been organized as

vertical themes, each with its own project management. The focus areas also utilize a network of field labs in which the practical, real-world research activities are performed in the contexts of, e.g., farming, forestry and horticulture.

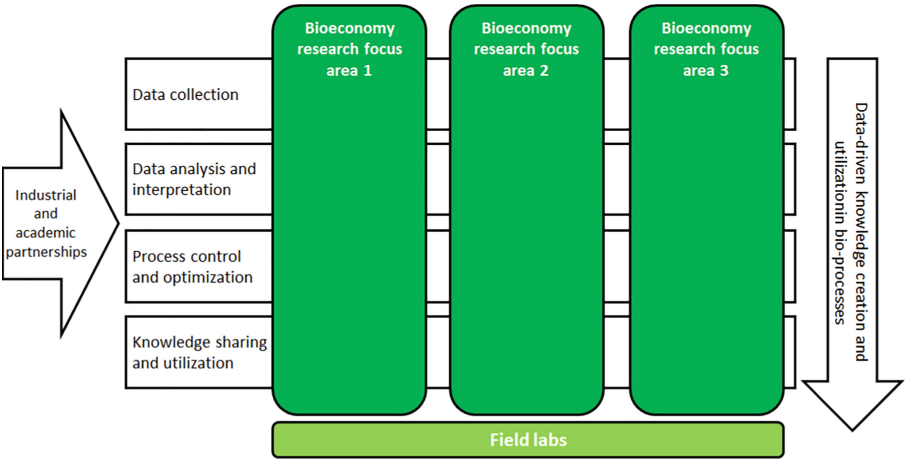

Fig. 1. Bioeconomy 4.0 research setting in which research focus areas have been organized as vertical units, and activities representing digitalization and data utilization serve all the focus areas as horizontal functions.

In this manner, all the focus areas relying on bioeconomy have their own research frameworks, including practical industrial cases as well as scientific research questions. Through these, the vertical focus areas connect to the partnerships representing both industrial and academic actors. Furthermore, as shown in Fig. 1, R&D assets facilitating digitalization, data analysis and IoT serve the framework as horizontal functions. In this manner, the competences and capabilities of full-scale data utilization can be integrated into the research and development activities carried out in each focus area.

Creation (and utilization) of external partnerships is an essential feature of the networked knowledge creation and utilization process that takes place within the Bioeconomy 4.0 framework. This means that each of the research focus areas connects to real-world industrial R&D topics through practical development cases conducted in close collaboration with industrial partners. In the same manner, activities in the focus areas are connected to research partners taking part in joint knowledge creation in the fields of the focus areas. In addition to this, the horizontally organized data utilization functions support close collaboration with relevant industrial actors as well as research institutes. A network of field labs is an essential part of the research framework. In the field labs, researchers and industrial practitioners can test their development ideas, build and evaluate prototypes and proofs-of-concept developed in the research projects. The field labs utilized in the Bioeconomy 4.0 framework represent, e.g., farming, forestry and horticulture.

Figure 2 presents a model of knowledge creation between industrial actors and the research framework. In this model, the research framework (as shown in Fig. 1) produces mainly theoretically oriented research-based knowledge, whereas the industrial

collaborators contribute with practical and experimentally oriented knowledge (often tacit in nature). As the researchers and industrial R&D staff work in close collaborative relationships within the research framework, they can jointly create new knowledge. The collaboration results are typically developed and validated in field labs.

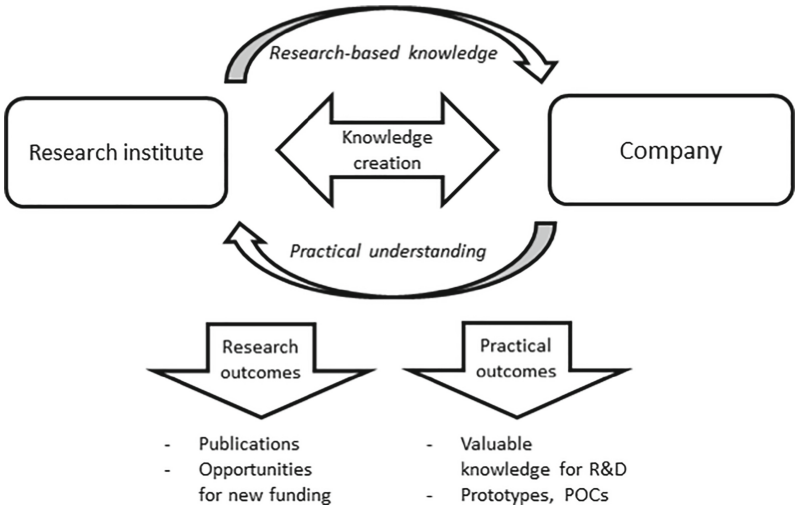

Fig. 2. Model of networked collaborative knowledge creation between the research institute and industrial partners

As shown in Fig. 2, networked collaboration taking place within the Bioeconomy 4.0 framework produces two types of outcomes. The research outcomes include academic and practical publications, such as scientific articles, practically oriented publications, guidelines and other documentation. In addition, the research results, successful partnerships and new competences acquired generate fresh opportunities for creating new research projects (and obtaining funding for these). The most important outcome for industrial partners is usually valuable new knowledge that can be utilized in firms' R&D to develop new products and services, and, in this manner, develop and sustain firms' competitive advantage [13]. In the research framework relying on field labs, research results are usually developed into prototypes and proofs-of-concept to smooth the path towards further development of industrial R&D work [9].

4 Discussion

The Bioeconomy 4.0 framework introduced in this paper contains two interconnected levels of networked collaboration. The research setting presented in Fig. 1 represents research-oriented collaboration practice in which two very different research fields, data utilization and bioeconomical processes) are brought together. This interdisciplinary collaboration is developed through a matrix-like setting in which digitalization and data utilization are organized as horizontal functions serving the vertically presented

bioeconomy research focus areas. This kind of setting ensures seamless communication and collaboration between researchers and developers from two distinct fields, and also fosters the development of new knowledge. All the research and development activities in this matrix setting rely on close collaboration with network partnerships, industrial and academic actors. The partnerships form a network in which both researchers and industrial developers act jointly, sharing their knowledge in order to solve complex multidisciplinary problems and jointly develop valuable new knowledge. As can be seen in Fig. 2, implementation of this joint knowledge creation has both practical outcomes and academic value. This kind of working model can foster new collaboration and deepen collaborative relationships between network partners [14].

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References

1. Morrar, R., Arman, H., Mousa, S.: The fourth industrial revolution (Industry 4.0): a social innovation perspective. Technol. Innov. Manag. Rev. **7**, 12–20 (2017)
2. Emden, Z., Calantone, R.J., Droge, C.: Collaborating for new product development: selecting the partner with maximum potential to create value". J. Prod. Innov. Manag. **23**, 330–341 (2006)
3. Bäck, I., Kohtamäki, M.: Boundaries of R&D collaboration. Technovation (2015)
4. Kunttu, I.: A managerial decision tool for R&D outsourcing and partner se lection in high-technology industries. Technol. Innov. Manag. Rev. **7**, 25–32 (2017)
5. Un, C.A., Cuervo-Cazurra, A., Asakawa, K.: R&D collaborations and product innovation. J. Prod. Innov. Manag. **27**, 673–689 (2010)
6. Chesbrough, H.W.: The era of open innovation. MIT Sloan Manag. Rev. **127**, 35–42 (2003)
7. Enkel, E., Gassmann, O., Chesbrough, H.: Open R&D and open innovation: exploring the phenomenon. R&D Manag. **39**, 311–316 (2009)
8. Ritala, P., Hyötylä, M., Blomqvist, K., Kosonen, M.: Key capabilities in knowledge-intensive service business. Serv. Ind. J. **33**, 486–500 (2013)
9. Kunttu, L., Neuvo, Y.: Balancing learning and knowledge protection in university-industry collaborations. Learn. Organ. **26** (2018)
10. Bellini, E., Piroli, G., Pennacchio, L.: Collaborative know-how and trust in university-industry collaborations: empirical evidence from ICT firms. J. Technol. Transf. **44**, 1–25 (2018)
11. Estrada, I., Faems, D., Martin Cruz, N., Perez Santana, P.: The role of interpartner dissimilarities in Industry-University alliances: insights from a comparative case study. Res. Policy **45**, 2008–2022 (2016)
12. Galunic, D.C., Rodan, S.: Resource recombinations in the firm: knowledge structures and the potential for Schumpeterian innovation. Strateg. Manag. J. **19**, 1193–1201 (1998)
13. Artz, K.W., Norman, P.M., Hatfield, D.E., Cardinal, L.B.: A longitudinal study of the impact of R&D, patents, and product innovation on firm performance. J. Prod. Innov. Manag. **27**, 725–740 (2010)
14. Verona, G.: A resource-based view of product development. Acad. Manag. Rev. **24**, 132–142 (1999)

Open Data Ecosystems in Public Service Development

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Abstract. Open data can be used to promote better information sharing and joint co-creation between public organizations such as cities or governments and their citizens. In addition to this, openly available data and open technologies provide new opportunities to develop new products and services in both the public sector and private businesses. This development often requires close collaboration between various stakeholders including software developers, research institutes, public actors such as governments and cities as well as commercial actors. Jointly developed co-creation models and practices are able to improve the commitment of different stakeholders and ensure that the created solutions are based on real needs. This kind of collaboration is particularly beneficial in, for example, the work related to smart city development.

Keywords: Open data · Ecosystems · Service development · Co-creation · Smart city

1 Introduction

In the development of smart cities there is a movement away from a top-down focus on city -planning and resource utilization towards opening of data and increased opportunities for citizens to be the drivers and the targets of urban innovation [1]. Smart cities are among the largest creators and collectors of data. These data are very valuable for citizens, organizations, and businesses for participation, decision-making and creating innovative products and services [2]. The role of a city is expanding from being the producer and buyer of services to an innovator of services [3] and a developer of ecosystems [4]. In this new model, citizens are increasingly invited to act as collaborators and co-creators in the development of new services [5].

In this paper, we consider the ecosystem development in the networks that are developing and utilizing open technologies for new service creation in both the private and public sectors. Based on the cases presented in this paper, we show how different scenarios for open data and open source software development may contribute to new service development. The research questions that frame the case studies are as follows:

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– How can public sector services be developed using an ecosystem model?
– How do open data enable public sector service development?

The focus of this paper lies in the open data ecosystems containing private companies, public sector actors, and research institutes. Therefor, this paper has a clear connection to smart city development in which the utilization of open data has a central role [6]. When considering the three streams of ecosystem research suggested by Jacobides et al. [7], the open data ecosystems studied in this paper are mainly in the area of platform ecosystems in which the stakeholders connect to a central platform via shared or open source technologies. This, in turn, enables the stakeholders to create complementary innovations and utilize them in the platform's customer interfaces [7]. In this manner, open data utilization in the smart city context may have outcomes that belong to the two other categories: business ecosystems and innovation ecosystems.

The results of this study will be used to develop the ecosystem work in the City of Hämeenlinna and the fuctionality of soft landing. Activities have already focused on the potential of open data, but there is still much to be done. A solution to the needs of the City of Hämeenlinna could be the Know Your Hoods online service, which is a new way of highlighting the attractiveness of municipalities and neighborhoods. The service serves both municipal representatives and potential movers who are exploring possible new neighborhoods. The service utilizes a variety of open data sources [8].

2 Co-creation of Value in Public Service Development

Many past and present business models have been developed from the viewpoint of product-dominant logic. The producers, e.g., companies or cities, have been perceived as value creators whereas customers or citizens have been perceived as value users. The value creation activities have been developed accordingly to include several independent functions, such as articulating the contents of the value propositions, identifying proper market segments, specifying revenue generation mechanisms, defining the structures of the required value chains, and distributing the complementary assets needed to support the producer's position in the value chain [9]. The focus has been on estimating cost structures and potential profits, as well as on gaining and maintaining competitive a advantage over rivals [10, 11].

Instead of seeing smart cities solely as the producers of tangible goods or intangible services, the service-dominant logic seeks to understand the logic and well-being of the entire service ecosystem. Based on ecosystem level actor-to-actor networks, the value is dynamically co-created through closely collaborating networks, which are filled with weak and often invisible ties [12] between the different network members [9]. Therefore, the actual value co-creation takes place within the different resource-integrating processes and activities, emphasizing the role of resource integrators as the creators of intangible resources that are beneficial to the entire value network encompassing public sector actors, software developers, research institutes, and commercial actors involved in the service development. The resources can either be tangible or intangible and internally controlled or externally drawn on for support, and therefor, never highlight the role of any particular member of the value networks [13–16].

3 Open Data Ecosystems

Borrowed from biology, the term ecosystem generally refers to a group of interacting firms or other networked institutions (such as public sector actors or educational institutions) that depend on each other's activities, and affect each other through their activities. Jacobides et al. [7] have identified three main streams of ecosystem research. Firstly, business ecosystems studies that focus on individual firms and view the ecosystem 'a community of organizations, institutions, and individuals that impact the enterprise and its customers and supplies' [7, 17]. Secondly, innovation ecosystems research that focuses on a particular innovation or new value proposition, as well as supporting actors. In this category, the ecosystem is seen as a 'collaborative arrangement through which the firms combine their individual offerings into a coherent, customer-facing solution' [18]. Thus, the emphasis is on understanding how interdependent players interact to create and commercialize innovations that benefit the end customers who actually use the end product. The third main category, platform ecosystems, considers how actors and stakeholders are organized around a particular platform and what interdependences there may be between the sponsors, complementors and other stakeholders in the ecosystem.

Open data and especially open government data have a significant role in public service development and smart city activities. Open data haves two roles when developing services and smart cities in an ecosystematical way. First, they enable communication between different actors depending on the role they play. Usually the most critical communication that open data aim to improve is between cities or administratives and citizen and public audiences. Open data make it possible to share information, but also makes activities more transparent. This also makes it possible for a wider audience to participate in decision making and, in this way, emphasize democracy. These are some of the benefits that also Bătăgan [19] describes. Open data not only improve communication between cities and citizens, new value can be found from connection between cities and companies or researchers.

Other aspects where open data play major role in developing new services where open data act as building material. In an era of digitalization and information, it is crucial to have access to all the data to develop better services. When data are accessible to everyone, the data owner no longer has to be the developer or provider of the new data-based service. This is easier to describe through examples. If a city transport administration opens all the timetable and route information, applications for travelers can be developed by anyone. It might be that the developer is just an active citizen capable of developing applications or it might be a company that sees a business opportunity by adding content, like analytics or by implementing it in existing products or services, like info kiosks.

Even though the benefits of open data are obvious, there are still many barriers that slow down the development. As Bătăgan [19] points out, barriers can be economic, technical, cultural or legal. The most important thing is to create a culture within public organizations to support open data activities and publish the open data. Without the proper attitude, it is impossible to force things to happen. After this, it is possible to start breaking down other barriers such as how to finance it, how to design and execute technical solutions and how to address the legal aspects of privacy, contracts and ownership of the data. It is important to notice that all the other barriers can be solved together with

stakeholders in ecosystems, but culture and attitudes within public organizations cannot be greatly influenced from the outside.

Viale Pereira et al. [20] states that to succeed in smart city and open government data activities, there is a need for inter-governmental and inter-sectorial partnership. Inter-sectorial partnership includes a variety of stakeholders like citizens, private companies and services, universities, developers etc. These collaborative open data and smart city activities have the potential to generate new value and create new private products and services. Simultaneously, governments can improve effectiveness which in turn leads to better decision making and improves the quality of life for citizens.

4 Case Study: City of Hämeenlinna

The City of Hämeenlinna is situated in the middle of the densely populated Southern Finland. The population of the city is around 68,000 inhabitants. Hämeenlinna is a balanced mix of urban environment and spacious, peaceful countryside with flourishing rural centres. Hämeenlinna started to develop ecosystems in 2019. Hämeenlinna aims to gather public sector, private companies, education, research, developers and citizens to work together in five different ecosystems which are called Renewing Industry, Sustainable Bioeconomy, Smart Services, Tourism and Events and Enabling City. These ecosystems are based on research carried out in 2018 where different stakeholders were interviewed about the vitality of the city.

For the stakeholders in ecosystems it is essential to have added value, trust and openness. For private companies, added value also includes new business opportunities. For universities, added value can come from research. For the City itself, value can be found in social or communality aspects. Stakeholders might participate in different roles in different projects.

All five ecosystems have their own facilitator who represents different organizations, so they are not just employees of the city. In addition to facilitators, every ecosystem needs a plan or roadmap to success. These roadmaps are planned together with all the stakeholders and so will fulfill all the needs of the participants. The framework for the road map was designed together with City of Tampere. Inside the ecosystems there is room for multiple teams to plan and run sub-projects and apply funding. This kind of collaborative work is the glue between different actors with shared values, vision and goals.

A good example of this thinking model is the Know Your Hoods online service, whose development work began on the basis of extensive research into people planning to move. The research were coordinated by the Regional Council of Southwest Finland and Turku Science Park Ltd. The service utilizes a variety of open data sources, such as geographic information, postal number data, housing sales price statistics, municipal data and the City of Turku's own open data. According to the results of the research survey, the majority of people who were planning to move would use the online information service from their neighborhood to support their decision to move. Based on the results, the choice of neighborhood is primarily influenced by safety, location, price, nature and reputation of the neighborhood.

Services, in particular traffic management and public transport, also have a major influence on the choices made. Only one in five respondents to the survey reported

using the city or municipality website to support their decision-making, but nevertheless expressed an interest in using the residential online service to support their relocation decisions. In practice, the service acts as a search engine for neighborhoods, helping people find the best place to live. The mission of the service is to make every citizen feel at home [21].

The online service makes it possible to serve the needs of municipalities in order to increase awareness and accessibility. The user (who is planning to move) can use the service to explore new neighborhoods with different search options. The search criteria can be used to determine the features they want from their future place of residence based on, for example, location, price, services, natural environment and built environment. The user can define their wishes very carefully, after which the service will suggest suitable residential areas. The neighborhoods are thoroughly described including their history, services and other fascinating information.

5 Conclusions

As mentioned earlier, the Know Your Hoods service could be the solution to the needs of Hämeenlinna. The service should be better designed for City of Hämeenlinna needs, but it serves as a great example of a service that operates on an open ecosystem model. The service is a good example of how a private operator can provide services like the public sector. It offers benefits to private companies, the public sector and research institutes. It is particularly important for the future that municipalities and organizations make more public sources of information accessible to all.

With the online service, various city units can also benefit from soft landing thinking, identifying new actors (such as real estate companies) and the services involved. The city's customer-oriented understanding and processes are evolving. The service facilitates interaction between municipalities and potential new residents. The online service also enables organizations to do more business while increasing the social value of the municipality. Similar open services provides an opportunity to educational institutions to implement different research and development projects where open data can be utilized.

According to the research [21], different groups of residents and movers have different needs. Price levels and public connections are often important to students, while factors that are important to families with children include schools and kindergartens, job opportunities, security and location. The neighborhood is perceived as having a major impact on well-being and quality of life. This is why a person considering a move is particularly interested in the experiences of existing residents in the neighborhood [21]. One of the aims of Hämeenlinna's ecosystem work has been to attract people in the age range 20–44 to move and stay in Hämeenlinna. A comprehensive residential service could contribute to this. With Know Your Hoods, organizations could target their services and products to their customers, while municipalities develop their community services.

The service is developed by a company called Choose Your Future. The goal is to develop a comprehensive residential portal for the needs of movers and residents together with users. The main theme of the service development is research and the participation of real users. Another goal is to develop the service to better serve the

needs of residents in existing neighborhoods [21]. This would also be a great opportunity to develop the service into an ecosystem-based service that supports Hämeenlinna's operations; working together and supporting each other.

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References

1. Cook, J., Lander, R., Flaxton, T.: The zone of possibility in citizen led 'Hybrid Cities'. Position Paper for Workshop on Smart Learning Ecosystems in Smart Regions and Cities. Co-located at EC-TEL, Toledo, Spain, September (2015)
2. Janssen, K.: The influence of the PSI directive on open government data: an overview of recent developments. Gov. Inf. Q. **28**(4), 446–456 (2011)
3. Ojasalo, J., Kauppinen, H.: Collaborative innovation with external actors: an empirical study on open innovation platforms in smart cities. Technol. Innov. Manag. Rev. **6**(12), 49–60 (2016)
4. Cotton, N.: The Smart City Cookbook. Tampere: City of Tampere, Department of International Affairs (2018)
5. Jussila, J., Kukkamäki, J., Helander, N.: Co-creating digital services for citizens: activity theory analysis. In: Proceedings of the 11th International Joint Conference on Knowledge Discovery, Knowledge Engineering and Knowledge Management-Volume 3: KMIS. Science and Technology Publications (2019)
6. Jussila, J., Kukkamäki, J., Mäntyneva, M., Heinisuo, J.: Open data and open source enabling smart city development: a case study in Häme Region. Technol. Innov. Manag. Rev. **9**(9), 26–35 (2019)
7. Jacobides, M.G., Cennamo, C., Gawer, A.: Towards a theory of ecosystems. Strateg. Manag. J. **39**(8), 2255–2276 (2018)
8. Know Yor Hoods knowledge of the servise. https://hoods.fi/info/users
9. Ketonen-Oksi, S., Jussila, J., Kärkkäinen, H.: Social media based value creation and business models. Ind. Manag. Data Syst. **116**(8), 1820–1838 (2016)
10. Chesbrough, H.: Business model innovation: opportunities and barriers. Long Range Plan. **43**(2–3), 354–363 (2010)
11. Chesbrough, H., Rosenbloom, R.S.: The role of the business model in capturing value from innovation: evidence from Xerox Corporation's technology spin-off companies. Ind. Corp. Change **11**(3), 529–555 (2002)
12. Granovetter, M.: The strength of weak ties: a network theory revisited. Sociol. Theory **1**, 201–233 (1983)
13. Lucsh, R.F., Nambisan, S.: Service-innovation: a service-dominant logic perspective. MIS Q. **39**(1), 155–175 (2015)
14. Vargo, S.L.: Toward a transcending conceptualization of relationship: a service-dominant logic perspective. J. Bus. Ind. Mark. **24**(5–6), 373–379 (2009)
15. Vargo, S.L., Lusch, R.F.: Service-Dominant Logic: Premises, Perspectives, Possibilities. Cambridge University Press, Cambridge (2014)
16. Vargo, S.L., Maglio, P.P., Akaka, M.A.: On value and value co-creation: a service systems and service logic perspective. Eur. Manag. J. **26**(3), 145–152 (2008)
17. Teece, D.J.: Explicating dynamic capabilities: the nature and microfoundations of (sustainable) enterprise performance. Strateg. Manag. J. **28**(13), 1319–1350 (2007)

18. Adner, R.: Match your innovation strategy to the innovation ecosystem. Harward Bus. Rev. **84**(4), 98–107 (2006)
19. Bătăgan, L.: The role of open government data in urban areas development. Informatica Economică **18**, 80–87 (2014)
20. Viale Pereira, G., Macadar, M., Luciano, E., Testa, M.: Delivering public value through open government data initiatives in a Smart City context. Inf. Syst. Front. **19**, 213–229 (2017)
21. Know Your Hoods research results. https://hoods.fi/blog/article/436

Public-Private Partnerships (PPPs) in Energy: Identifying the Key Dimensions from Two Different Bibliometric Analyzes

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Abstract. Public-private partnerships (PPPs) have been considered as one of the primary mechanisms to mobilize social capital towards infrastructure and services in the energy sector on a global scale. However, the lack of understanding of PPPs in the energy sector has been highlighted as a limiting factor for the full and successful implementation of PPP projects. Accordingly, this research seeks to identify the main dimensions of PPPs in the energy sector. A systematic search was conducted for that purpose. Furthermore, the present study included the application of two different bibliometric packages as analytics tools: VOSviewer and Leximancer. Both different computational approaches were used to identify key dimensions and compare them with results of manual content analysis. The five key dimensions emerged as 1) PPP projects, 2) renewable technologies and electricity in the energy sector, 3) hybrid energy governance, 4) risk and 5) sectoral interlinkages. The development of innovative approaches related to hybrid energy governance and the growing sectoral interlinkages reveals the need for more flexible and participatory PPPs to facilitate the energy transition.

Keywords: Public-private partnerships · PPPs · Energy · Key dimensions · VOSviewer · Leximancer · Projects · Risk · Governance · Electricity

1 Introduction

Public-private partnerships (PPPs) offer an attractive alternative for building solid actions towards the promotion of energy infrastructure and associated services [1]. According to the Private Participation in Infrastructure (PPI) project database, of almost 6 900 PPP projects registered since 1990, more than 3 200 PPP electricity projects have been developed in low-income to upper-middle-income countries [2]. Notwithstanding, the relevant participation of PPPs in the energy scenario, current challenges of energy sector

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related to the transition to low-carbon technologies, digitalization and decentralization of energy resources require capital effort and strong collaboration between public and private sectors [3]. Consequently, the scope of PPPs would not be limited to a financing source for energy infrastructure but also as a key factor in consolidating the necessary changes from project level to policy level.

The previous literature in this matter is still scattered and sparse based on the fact there is not a universally accepted definition for PPPs [4]. Hence, there is an urgent need for research on the topic and uncovering the key dimensions of PPPs in the energy sector. To shed light on this important issue, we conducted a systematic search followed by a text mining and topic modelling process using two bibliometric packages: VOSviewer and Leximancer. On one side, VOSviewer is focused on building co-occurrences networks based on large text data [5]. On the other side, Leximancer analyzes textual documents through interactive maps, providing the conceptual structure of a corpus text [6]. Bearing our goal in mind, we used the above-mentioned data analytics tools to identify key dimensions of PPPs in the fast-changing sector and compare them with the results of manual content analysis [7].

2 Methodology

This paper pursues uncovering key dimensions of PPPs in the energy sector through the analysis of the recent literature. Our methodology approach included the following stages: firstly, a systematic search of review and research articles. Second, bibliometric analyzes through a text mining and modelling of the full-text by using VOSviewer and Leximancer. Third, a manual content analysis. Four, an interpretation of results from both applications followed by a comparison between computational and manual approaches.

2.1 Data Collection and Document Pre-treatment

We delimited the perimeter of our data collection to research and review published articles written in English from 2015 to 2020. The search was conducted in Scopus by using the keywords "*public-private partnerships*" or "*PPPs*" and "*energy*" excluding several possible uses of the acronym "PPP" (i.e. purchasing power parity). After a scrutiny process, we obtained a final sample of 83 peer-reviewed academic articles. The subsequent step included a documents pre-treatment process before the text mining to remove data that could generate wrong co-occurrences. Afterwards, the documents were converted into a machine-readable format (plain text files). Additionally, to this, we developed a thesaurus file with grammatical variants and stem derivational words.

2.2 Text Mining and Modelling, Manual Content Analysis, Interpretation and Comparison

Text mining and modelling in VOSviewer provide two-dimensional maps based on co-occurrences [5]. The process comprised four steps: 1) noun-phrases identification, 2) screening noun-phrases, 3) mapping and clustering and 4) results from visualization [5]. Our interaction with VOSviewer started by uploading the machine-readable text file.

Subsequently, we set a counting method as well as a threshold number and uploaded the thesaurus file. Then, we proceeded to remove words with general meaning. Later, we set the density visualization in terms of resolution of 0.90 and a level of attraction of 2. As well as VOSviewer, Leximancer uses corpus files to find relevant concepts and to cluster them into high-level themes [6]. The themes and concepts are shown in two-dimensional heated-maps according to the number of hits and its connectivity. The Leximancer algorithm consists of three stages as 1) generating concept seed, 2) generating a thesaurus, and 3) generating a concept map [6]. The first step in Leximancer was uploading machine-readable format files. We proceeded to remove words with a general meaning, merged grammatical variants and created compound concepts. The concept map was set with a theme size of 70%. After bibliometric analyzes through a text mining and modelling process, we compared the main aspects of using both data analytics tools. Subsequently, we developed a manual content analysis. This stage was followed by an interpretation of the results from VOSviewer and Leximancer and, it finished with the comparison between computational and manual approaches.

3 Results

3.1 Text Mining and Modelling Using VOSViewer and Leximancer

The density visualization showed a map of 56 concepts grouped in four clusters that we labelled according to the most relevant concepts as 1) *financial aspects of PPP project*, 2) *energy and regulatory framework*, 3) *partnership and context* 4) *risk, infrastructure and sectoral interlinkages* (Fig. 1).

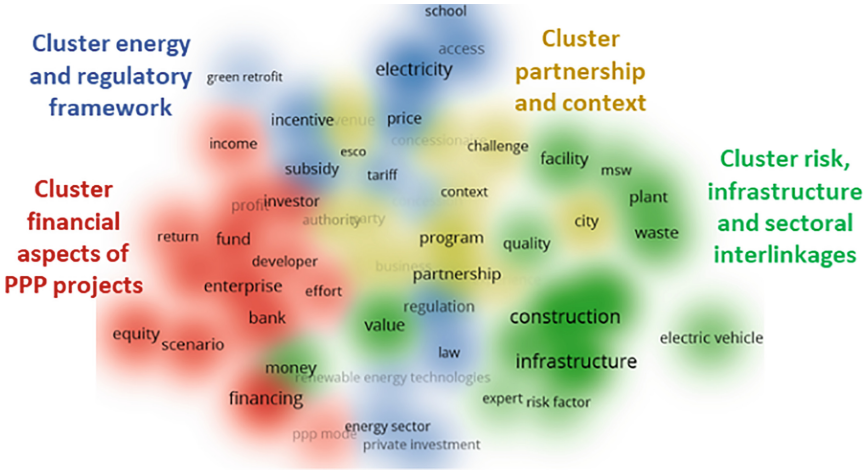

Fig. 1. Density visualization in VOSviewer with concepts grouped into four clusters

In Leximancer, the concept map shows a network of 55 concepts grouped into four themes labeled as 1) *projec*t, 2) *risk*, 3) *power* and 4) *hybrid energy governance*. It is

worth mentioning that concerning to the cluster number four, Leximancer labeled it as "*non-state*". However, after an exploration of the literature related to that theme, we discovered that the underlying idea was "*hybrid energy governance*", for this reason, the label was manually adjusted (Fig. 2).

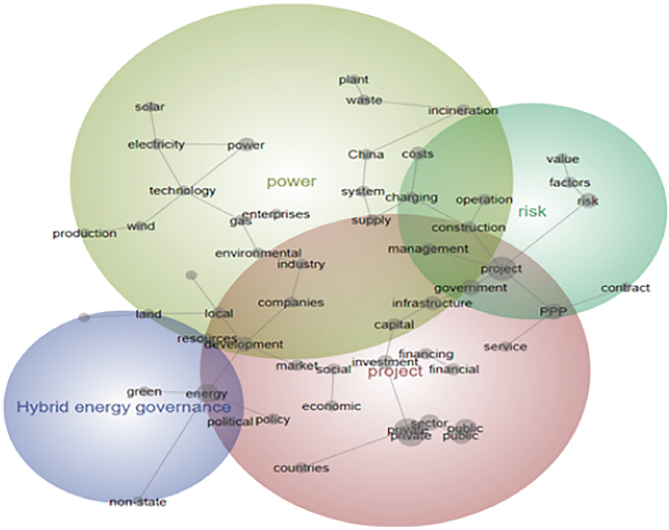

Fig. 2. Concept map in Leximancer with concepts grouped into four themes

In addition to the concept map and the density visualization, other aspects were also important for using these data analytics tools. For instance, the type of access, reports, granularity, manual settings, etc. Therefore, we present a comparative table that summarizes the main features of using VOSviewer and Leximancer (Table 1).

3.2 Identification of Key Dimensions Using Manual Content Analysis, Interpretation and Comparison with Computational Approaches

We found our sample highly heterogeneous. First, the data set included applications of quantitative models (i.e. financial models, risk assessments, etc.), mixed methods, qualitative case studies and conceptual papers. Second, the majority of the PPP energy applications involved renewable energy, energy storage, energy efficiency and green infrastructure. This finding indicates the key role that PPPs are taking in the energy transition. From bibliometric analyzes and manual content analysis, five key dimensions emerged as:

1) First dimension was called "*PPP project*". This dimension includes main features of PPPs that are not restricted only to the energy sector: i) PPP as a financial and infrastructure delivery mechanism [8]; ii) value-added from PPP projects; iii) Value-for-Money, and iv) barriers for successful implementation.

Table 1. Comparison between VOSviewer and Leximancer

Aspect	VOSviewer	Leximancer
Access	Free available software	Paid license
Process		
Document pretreatment	Removing words that could provide wrong co-occurrence and comprising all articles in a machine-readable text file	Removing words that could provide wrong co-occurrences
Principal input	A single machine-readable text file with corpus texts	Leximancer supports different text document types but we used plain text files
Thesaurus	Externally created	Automatically created
Manual settings	Threshold number, a minimum number of occurrences, number of terms for analysis, verify selected terms	Sentences per block, prose test threshold, stop-word removal, identification of name-like concepts, etc.
Results		
Mapping core categories	Activating "*cluster density*" option. Clusters are represented by clouds. Each cluster is labeled with a number	The concept map automatically appears. Themes are represented by circles. The boundaries and intersections between themes are clear. Each theme is labeled according to the relevance and connectivity of the main concept
Mapping concepts network	In the "*network visualization*" window, it is possible to visualize the connections between concepts	A network of concepts is presented as a layer of the concept map
Granularity	Clusters formation and visualization can be set according to the desired level of detail	Exploration of different themes size is possible as well as the text blocks connected to themes
Statistical resources	Using the version 1.6.11, we could not find statistical reports available to download	Leximancer offers a set of statistical resources for further analyzes of connectivity and occurrences

2) The second dimension corresponds to "*renewable technologies and electricity in the energy sector*". It comprises specificities of the energy sector: i) particular contractual arrangements in the energy sector; ii) applications of renewable energy technologies, green infrastructure and energy efficiency in PPP projects; iii) PPP electricity projects towards energy transition [9]; iv) electricity as a crucial strategy

against poverty (pro-poor PPPs) [10]; vi) strong connection of PPP energy projects and sustainable development.

3) The third dimension was called "*hybrid energy governance*". This approach indicates the relevance of PPPs in energy issues from a single project level to a cross-national decision-making level [4, 11, 12]. Since energy scenarios are changing, interactions between public and private sectors are evolving to more flexible and collaborative schemes.
4) The fourth dimension is "*risk*". Risk transfer is one of the motivations for building PPPs and a critical success factor. A significant number of articles in our sample included risks exploration [13].
5) Fifth dimension is "*sectoral interlinkages*". The literature indicates the role of energy PPP projects as a bridge for sector coupling with waste management, water supply, transport, ICT and agriculture [14, 15].

From the above described analyzes, we highlight that both software were useful for the identification of key dimensions of PPPs in energy. Both approaches presented several commonalities with our manual content analysis. For instance, the dimension "*renewable technologies and electricity in the energy sector*" keeps certain similarities with the cluster "*energy and regulatory framework*" in VOSviewer and the theme "*power*" in Leximancer related to the presence of electricity and renewable energies. Likewise, the dimension "*PPP project*" shows relatively strong affinity with the theme "*project*" in Leximancer and several correspondences with the cluster "*financial aspects of PPP projects*" in VOSviewer. On the other hand, the dimension "*hybrid energy governance*" was found only in Leximancer. Therefore, after comparing our manual content analysis with the formation of clusters and terms in VOSviewer as well as themes and concepts in Leximancer, we concluded that results from Leximancer were closer to our manual content analysis than VOSviewer.

4 Conclusions

Five key dimensions of PPPs in the energy sector were identified as 1) *PPP projects*, 2) *renewable technologies and electricity in the energy sector*, 3) *hybrid energy governance*, 4) *risk* and 5) *sectoral interlinkages*. Furthermore, the multiple applications of renewable energy technologies demonstrate that PPPs play a prominent role in the current process of the energy transition. However, the emergence of novel approaches related to hybrid energy governances and the increasing trend of sectoral interlinkages, expose the need for more flexible and participatory collaborations between public and private sectors to facilitate the energy transition, digitalization and distributed energy resources.

Regarding the exploration of VOSviewer and Leximancer, our main conclusion is that both software provide valuable information to identify where the current literature of PPPs in the energy sector is focused on. Although the results present variations among different bibliometric analyzes, they keep commonalities in the main patterns. In general, results from Leximancer were closer than VOSviewer to our manual content analysis. Furthermore, Leximancer provides a complete set of alternatives to explore statistical resources as well as the connection between results with text blocks. One

insight from the present study is the relevance of conducting a manual content analysis as a complementary strategy to provide an accurate interpretation of results from automatic data analytics tools.

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References

1. Wu, Y., Li, L., Xu, R., Chen, K., Hu, Y., Lin, X.: Risk assessment in straw-based power generation public-private partnership projects in China: a fuzzy synthetic evaluation analysis. J. Clean. Prod. **161**, 977–990 (2017)
2. World Bank. Private Participation in Infrastructure (PPI) project database. https://ppi.worldbank.org
3. Cruz, C.O., Sarmento, J.M.: Reforming traditional PPP models to cope with the challenges of smart cities. Compet. Regul. Netw. Ind. **18**(1–2), 94–114 (2017)
4. Heldeweg, M.A., Sanders, M., Harmsen, M.: Public-private or private-private energy partnerships? Toward good energy governance in regional and local green gas projects. Energy Sustain. Soc. **5**(9), 1–12 (2015)
5. Van Eck, N.J., Waltman, L.: Text mining and visualization using VOSviewer, pp. 1–5. arXiv preprint arXiv:1109.2058 (2011)
6. Leximancer: Leximancer User Guide: Release 4.5 (2018)
7. Naukkarinen, O., Bragge, J.: Aesthetics in the age of digital humanities. J. Aesthetics Cult. **8**, 1–18 (2016)
8. Di Liddo, G., Rubino, A., Somma, E.: Determinants of PPP in infrastructure investments in MENA countries: a focus on energy. J. Ind. Bus. Econ. **46**(4), 523–580 (2019)
9. Ari, I., Koc, M.: Sustainable financing for sustainable development: agent-based modeling of alternative financing models for clean energy investments. Sustainability **11**(1967), 1–34 (2019)
10. He, G.: Financing the last mile of electricity-for-all programs: experiences from China. Econ. Energy Environ. Policy **8**(1), 51–58 (2019)
11. De Carvalho, L.: Rethinking the continuum between public and private actors in electricity policy in the context of the UK energy transition. Sociologický časopis/Czech Sociol. Rev. **54**(6), 881–906 (2018)
12. Grotenbreg, S., Van Buuren, A.: Facilitation as a governance strategy: unravelling governments' facilitation frames. Sustainability **9**(1), 160, 1–18 (2017)
13. Xu, Y., Chan, A.P., Xia, B., Qian, Q.K., Liu, Y., Peng, Y.: Critical risk factors affecting the implementation of PPP waste-to-energy projects in China. Appl. Energy **158**, 403–411 (2015)
14. Liu, J., Wei, Q.: Risk evaluation of electric vehicle charging infrastructure public- private partnership projects in China using fuzzy TOPSIS. J. Clean. Prod. **189**, 211–222 (2018)
15. Wang, K., Ke, Y.: Public-private partnerships in the electric vehicle charging infrastructure in China: an illustrative case study. Adv. Civil Eng. **2018**, 1–10 (2018)

Rural Tourism Development Proposal. Case Study: The Commune El Palmar, Santa Elena Canton, Ecuador

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Abstract. Tourism activities in rural areas in Latin America and the global consensus on the subject, simplistically links tourism as a solution to poverty and environmental protection. 26.1% of the Ecuadorian population prefers to visit the rural area, feel linked to nature, peace and harmony, breathe fresh air, have a more natural and healthy way of life. Therefore, the objective of studying the subject is to enhance the tourism offer for the local and rural development of the Palmar commune, taking advantage of the natural tourist attractions that it has, through ecological tourism with a proposal of an ecological path to María Guare hill, Palmar beach and Rosada beach, through the Mangrove and the cliff, in order to raise awareness and conserve this natural resource through environmental education, while generating a source of economic income for the Commune.

Keywords: Rural tourism · Visual landscape · Ecotourism · Touristic offer · Natural resources

1 Introduction

The global consensus on rural tourism has consolidated national public policies, and has established a development model in which it covers the implementation of programs and incentives linked to tourism, as a means of development and the fight against poverty and, also, For the protection of the environment. The implementation of tourism activities in rural areas in Latin America has placed strong expectations as a promoter of change, both socially and economically and ecologically [1].

According to data from the Ministry of Tourism of Ecuador, this contributes directly to 1.96% of GDP. The activity is of vital importance for the economy, given that 665,639 people are hired directly by tourism companies. In addition, it generates 4.02% of the net taxes of the national economy. And ecotourism and nature tourism, through which the mega natural diversity is valued considering that 20% of the territory is managed under some protection order [2].

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According to a survey on domestic tourism in 2002 to 2003, 26.1% of the population prefers to visit the rural area, feel linked to nature, peace and harmony, breathe pure air, have a more natural way of life and healthy [3].

The Palmar Commune has the challenge of excelling and positioning itself as a destination that complements the Spondylus Route, with the offer of its natural attractions, a new socioeconomic source can be achieved in the commune, which contributes to the development of the sector. It has a mangrove spot of approximately 32 ha, an extension of the beach, an estuary, a wavebreaker, a splendid Sanctuary located on the María Guare hill 50 m above sea level, with a pleasant view of all its surroundings from where is it located.

2 Materials and Methods

2.1 Delimitation of the Study Area

Palmar was created as a Commune on February 22, 1938 by Ministerial Agreement No. 185. It belongs to the Colonche Parish, Santa Elena Canton, Santa Elena Province and has an extension of 2,303.70 ha. It is located 30 km NE of its Santa Elena cantonal head at UTM coordinates: 9′776.550 south latitude and 529.650 west latitude, approximately 190 km, west of Guayaquil, 1.5 km from the Santa Elena route - Blanket. At an altitude of 5.00 m above sea level, it limits to the north with the Ayangue Commune, to the south with the Jambelí Commune, to the east with the foothills of the Colonche mountain range and to the west with the Pacific Ocean (Fig. 1).

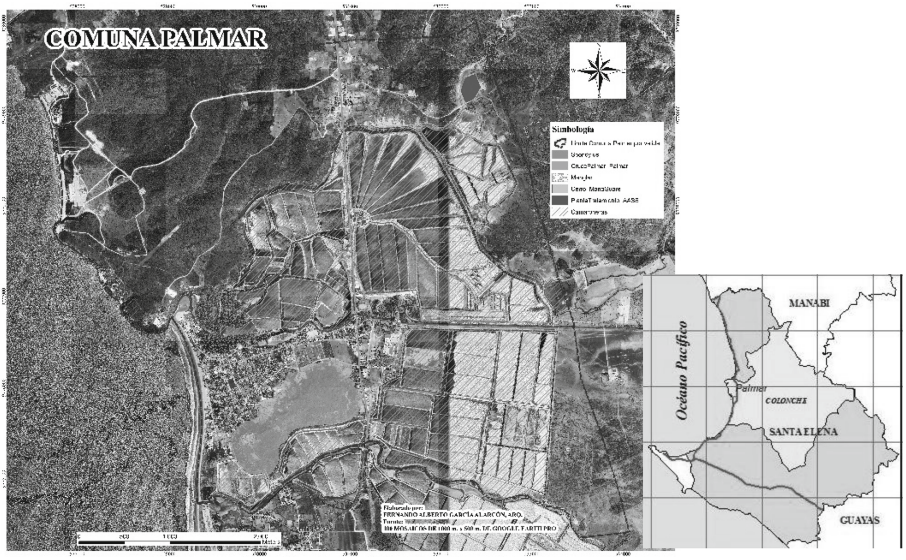

Fig. 1. Location of area of study Source: Own elaboration.

2.2 Methodology

To enhance the tourist offer, of the natural tourist attractions that the Palmar commune has, with a proposal of an ecological path to the María Guare hill, the Palmar beach and the Rosada beach, through the Mangrove and the Cliff.

With the use of the Methodology for the Ranking of Attractions, Georeferencing and Generation of Tourist Spaces in Ecuador, as a tourism planning tool that identifies natural resources at the national level with sufficient potential and attributes to be developed as tourist products and later associativity for the generation of comprehensive and planned tourist spaces. In this way, the attractions are identified, classified and hierarchized, to structure routes and/or circuits through the grouping of tourist attractions within the same geographical space [4] (Table 1).

Table 1. Natural Tourist Attractions Matrix of the Palmar Commune Source: Own elaboration.

Name		Maria Guare Hill	Mangrove swamp	Palmar Beach	Rosada Beach	Cliff
Province		Santa Elena				
Canton		Santa Elena				
Parish		Colonche				
Destination		Palmar Commune				
Category		Natural places				
Type		Coast or Coast				
Subtype		Visual landscape	Mangrove Ecosystem	Beach	Beach	Visual landscape
Hierarchy		II	II	II	II	II
Description		Attractive with some striking feature that presents basic conditions for the generation of tourism products able to interest visitors who had arrived in the area for other tourist motivations or to motivate national tourist currents				
Administration	Public			x		x
	Private				x	
	Community	x	x			
Others						
Latitude		−80.72705	−80.73383	−80.73602	−80,74935	−80.74248
Length		−2.02941	−2.01962	−2.02506	−2,00747	−2.02030

Hiking is the activity where you can thoroughly know the place you visit and have a connection with nature. Bathing on the beach is an activity that is considered fun. And the activity of kayaking or canoeing, is also done [5] (Fig. 2).

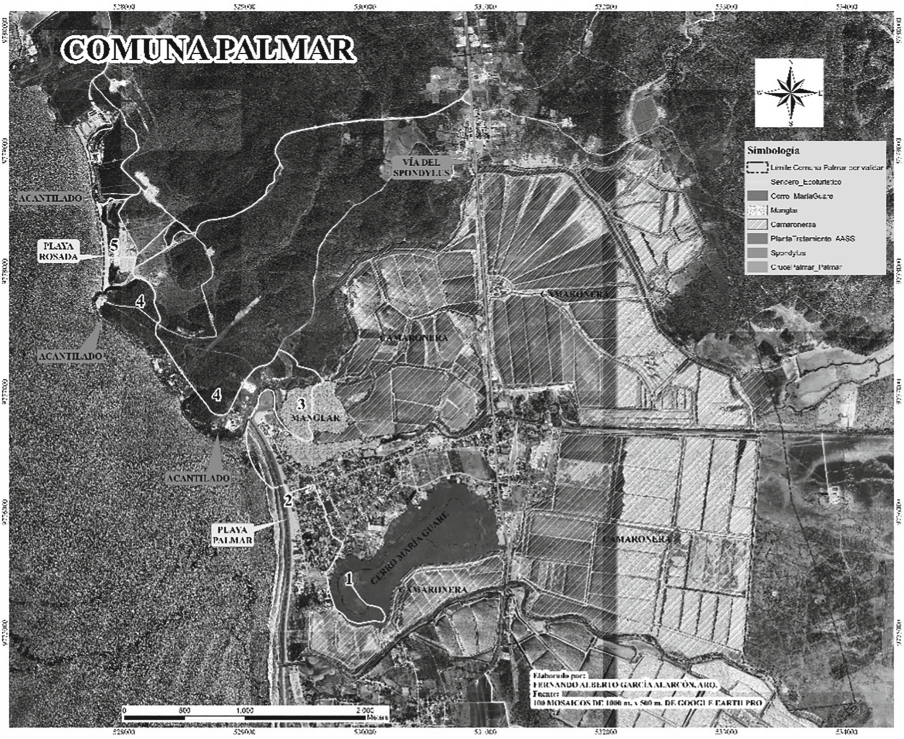

Fig. 2. Ecotourism trail proposal Source: Own elaboration.

The trail begins first, on the hill María Guare (1) where you can see the flat rural visual landscape, with the Chongón-Colonche mountain range covered with background tree vegetation; the population with the mangrove in the background; and, Palmar beach with the cliff in the background;


Second, bathe and have fun at Palmar Beach (2);


Third, kayak or canoe ride through the mangrove (3), from Palmar beach;


Fourth, view and walk along the cliff (4);


And fifth, bathe and have fun at Rosada beach (5).

3 Conclusions

The importance of ecotourism at an international level, as a socio-cultural dimension and the economic benefits that it generates for any country, as well as, the conservation of a planet that sees its natural resources lost rapidly, is for everyone, another one of many challenges.

The success factors for ecotourism, is participation, empowerment over natural resources and territory of the community, good management and collective distribution and have leadership that promotes good governance according to their needs.

With the offer of ecological tourism, with the conservation of existing natural resources such as the hill, beaches, mangroves and the cliff, will increase the economic benefits generated by this activity, in the Palmar Commune.

Although the community has an interest and willingness to take part, it needs an adequate organizational capacity.

References

1. Kieffer, M.: Community Rural Tourism and collective organization: a comparative approach in Mexico. Steps Rev. Tur. Patrim. Cult. **16**(2), 429–441 (2018)
2. Ledesma Gruezo, M., Peñaloza Zambrano, A., Gálvez Izquieta, P.: Community Tourism vs. Community ventures. Rev. Univ. And Soc. (2018)
3. Alcívar, G., Alberto, W., Iñiguez, R., Mgst, K.L.: Tourism and Hotel Business Subject: Intervention Plan for the Diversification of Tourist Products in the Palmar Commune, Santa Elena Province Degree work prior to obtaining the Title of: Tourism Business Administration Engineer (2016)
4. Chicaiza, X., Benítez, F., Guzmán, G.: Manual Generation of Tourist Offer. Minist. Tur. vol. MINTUR, 2nd, p. 22 (2019)
5. Larriva Ampuero, G., Hinojosa Moncayo, J.P., Gutiérrez Northía, A.: Good practices in ecotourism. Case study: Guayas province, Ecuador. Rev. Univ. And Soc. **10**(1), 150–155 (2018)

Human and Social Capital

Leadership Competencies for Digital Transformation: Evidence from Multiple Cases

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Abstract. Digital transformation (DT) is disrupting industrial organizations, which require significant changes in their properties to remain competitive. This calls for strong leadership to drive this transformation. However, what leadership competencies are required to lead DT impactfully is unclear. Therefore, we seek to identify the key leadership competencies by employing a qualitative, grounded theory approach. By conducting interviews of ten DT experts from two hardcore industrial organizations, we highlight five key leadership competencies that industrial organizations need to develop in their leaders: digital vision, digital knowledge, failing fast, empowerment, and managing diverse teams. The results of this study will help industrial organizations to strategically prepare their leadership for the requirements of DT.

Keywords: Digital transformation · Leadership · Competencies · Digitalization · Industry 4.0

1 Introduction

In this era of the fourth industrial revolution, industrial organizations require revolutionary changes to sustain themselves and remain competitive [1]. There are different factors behind these changes requirement, such as surging customer expectations and unprecedented competition, however, exponential technological development remains the biggest reason [2, 3]. To address this technological development, industrial organizations are radically transforming themselves to gain operational efficiency by introducing new digital technologies as well as by changing their social systems [4, 5]. However, industrial organizations require strong leadership at the helm [6] to lead this transformation impactfully. Strong leaders actively recognize when the change is required, understand the requirements for it, and foster an environment that supports the change [7]. Furthermore, leaders provide vision for the change from an existing state to a new improved state and prepare people to adapt enthusiastically to compete [7]. Moreover, they assess the change hardiness, prepare for resistance, gain support for change, involve people in decisions that affect them, provide clarity regarding behavioral expectations,

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create opportunities to practice new skills, use the feedback process to monitor implementation, reward and reinforce both progress and success, and align systems to support the new and desired behaviors [8]. The same holds true for those leaders who are leading the change for digital transformation (DT).

DT is a process that aims to improve organizations by triggering significant changes to their properties through combinations of information, computing, communication, and connectivity technologies [5]. It helps industrial organizations to make a fundamental shift from a traditional organization (industrial economy based) to an modern organization (one suited for today's digital economy) [1, 9]. Moreover, DT enables industrial organizations to develop agility, collaboration, innovation, enhanced customer experience, streamlining operations, and new business models [1, 10]. However, it require organizations to take company-wide initiatives [11] to transform the culture, structure, strategy, business processes, and business models [2, 10]. Hence, DT is not just about the introduction of new technologies; rather, it is about taking holistic steps to transform overall organizational properties to reap the full benefits it offers. Therefore, organizational leadership must work accordingly to ensure optimization between these new technical and social systems [12, 13]. However, the literature shows that industrial organizations struggle to embrace the opportunities through DT [14]. This finding challenges organizational leadership to reinvent their competencies to lead DT in their organizations [5].

Leadership competencies are the knowledge, skills, abilities, and attributes that leaders must possess to perform their jobs proficiently [7]. The existing literature on leadership competencies and DT has mostly focused on certain profiles such as chief digital officers or chief technical officers [15, 16], who actually develop and lead DT programs in their organizations. However, the literature has ignored the competency requirements of functional level leaders that actually implement DT in practice. Moreover, the literature lacks an empirical study that explores the key competencies of functional level leaders. Therefore, our main objective is to explore the key competencies required of functional level leaders to lead DT impactfully in industrial organizations.

2 Methodology

Our research is based on a multiple case study design that examines the key competencies of organizational leadership for digital transformation [17]. As DT is an evolving phenomenon in the literature [18, 19], we therefore used qualitative methods to collect and analyze the data [20] to extract the key competencies of leadership required for DT. We chose two industrial organizations as case companies, based on methodological expediency [21]. Both case companies are hardcore engineering industrial organizations that were established during the second industrial revolution [9]. Moreover, both are already working intensively on DT.

We relied on semi-structured interviews and publicly available documents of the case companies to identify the leadership competencies in question. We conducted in total ten interviews from experienced leaders who are leading DT in their functions. The interview transcripts compromised 170 pages and over 700 min of recordings. Furthermore, we used a grounded theory approach to analyze the data [22]. For this purpose, we used

NVivo 12 for coding. In addition, we followed the data analysis technique of Gioia, Corley, & Hamilton (2013) in which data is organized into concepts and thereafter themes are developed that facilitate the identification of leadership competencies.

3 Results and Discussions

In the analysis, five main competencies of leaders emerged that are critical for DT of industrial organizations. These five competencies are discussed in the following.

Digital Vision
The first step toward DT is having a strategic vision to lead it [23]. Vision in the context of DT is referred to in the literature as "Digital Vision" [11, 24]. Digital vision require leaders to look beyond existing strategies and previous procedures and envision the digital future of their organizations [11]. However, it requires leadership to align their actions with their vision and make it understandable for their subordinates. The director of DT stated the importance of vision, "*The key role of leaders is to inspire their people with purposeful vision that can engage those people emotionally for DT.*" However, another Director of DT stressed the need for alignment between vision and action, "*the capability of a leader is not just to have a vision but how he conveys that vision in an understandable and easy way to its people, so that they can buy his vision.*" The general manager of operational development explained this with an example, "*If you want everybody to start using some digital tools and then you go with paper handouts, it's kind of not strengthening your message.*" Therefore, leaders need to provide a purposeful vision in their organization and implement it by designing actionable plans around this vision.

Digital Knowledge
Having the knowledge of digital tools and processes emerged as one of most important competences that leaders must have to lead DT. However, the interviewees emphasized that the leaders are not required to possess hardcore technical knowledge for this purpose; rather a good understanding of digital tools is enough. The director of DT explained, "*I don't think they (leaders) should be expert in technology…what they should understand literally is how can a certain technology in broad terms impact our customers' business and our business.*" Similarly, the general manager of operational development noted, *"you (leaders) don't need to be a coder…but you must understand how we can utilize a particular technology?*" Another director of DT stated that "*It is (technical competence) definitely essential…they don't need to know it from scratch…but at least one should understand the impact of these technologies and the potential of these technologies on the business.*" Some scholars also have reported similar views regarding this competence. For example, Singh and Hess (2017) [11] emphasized that the leaders must understand the information technology (IT) applications, as new products and services are based on IT. Petrucci and Rivera (2018) [25] reported how digital technologies can help leaders at work, e.g., utilizing digital technologies to enhance real-time feedback and to derive behavior change, performance improvements, and understand the complex flows. Based on these views, we argue that the leaders of DT must have a basic knowledge of these

emerging new digital technologies, how these technologies can influence their businesses and operations, and how they can utilize these technologies to ensure the impactful DT of the incumbent organizations.

Failing Fast

Failing fast is one of the most frequently mentioned competencies by the interviewees. The literature as well as the interviewees have addressed the failing fast competence in relation to experimental learning, risk taking ability, using digital technologies in minimizing risk, and the fail and learn attributes of leaders [26]. Failing fast is an agile strategy that reflects the responsive timing of a failure within a given process [27]. The aim of failing fast is to recognize conditions which indicate a potential failure and then cease work on that task/project rather than investing more time and resources on it [28]. The vice president of open innovation explained, "*leaders need to be able to go through with something (project/tasks) and then stop, analyze is it working? And then be able to adjust quickly if things are failing.*" The director of DT explained this competency by stating, "*let's learn and fail together, and improve. That's what I been doing myself as a leader.*" Therefore, leaders must develop capabilities to fail and learn fast in order to save resources for their organizations, and digital technologies can play a vital role in achieving this purpose.

Empowerment

Empowerment, or the delegation of power toward those lower down the hierarchy, has emerged as another very important competency that is required to ensure impactful DT for industrial organizations. It helps in enhancing the meaningfulness of work, fostering participation in decision making, expressing confidence in high performance, and providing autonomy from bureaucratic constraints [29]. Almost every interviewee stressed the need of delegation of power for DT. The director of IoT stated, "*Leadership needs to transform from power to empower… that you need to empower your people to take the decisions because what they are working on is so big and complex that if you think you as a leader can do that, you will be the bottleneck.*" Meanwhile, the director of DT explained, "*We (as a leader) want everyone to feel empowered,*" and the senior director of global technology said, "*You (as a leader) need to trust more and you need to empower more (for DT)*". Therefore, by delegation of power, leaders can focus more on strategic aspects, as well as helping their teams to feel part of this whole transformation.

Managing Diverse Teams

DT requires business and IT teams to work together to define, design, deliver, prioritize, implement, enhance, and discard new digital services and products [30]. Moreover, industrial organizations develop cross-functional teams [5] to bring different resources to one place in order to start different projects. In addition, DT has enabled employees to work in virtual teams [31]. Therefore, leaders need to develop this competency to manage such diverse teams through different mediums. The director of DT mentioned the need to align their teams first, "*For me, the first thing is to create a clear purpose of our team…I arrange one hour meeting per week with each of them as building trust is very important in team management…you have to manage each team member differently.*" Director digital development added, "*In order to deliver complex projects, you need to develop*

diverse teams, therefore leaders must have the capability of building networks quickly to gather required diverse resources." Hence, the competency of managing diverse teams effectively is very important for the leaders of this digital age. Figure 1 presents the research framework for this paper.

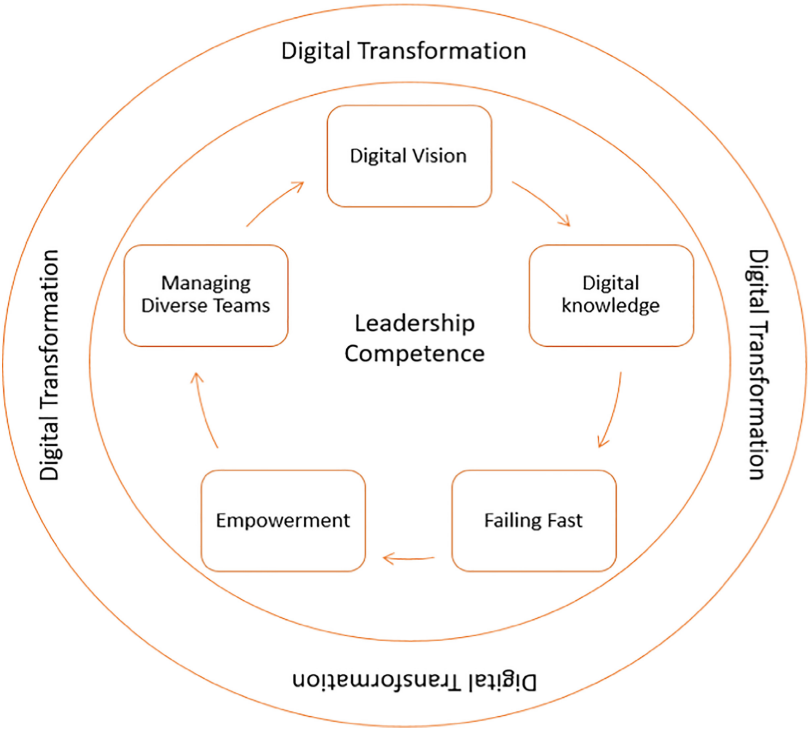

Fig. 1. Research framework

4 Conclusion

DT is all about change, and leaders are the pioneers to implement these changes in industrial organizations. Moreover, DT is not only affecting industrial organizations but also changing the context and conditions for the leaders. Therefore, leaders must reinvent their competencies to drive DT successfully in their organizations. Leaders across the organization must have a clear vision about the possibilities that digital technologies offer and how to implement these. Along with this understanding, leaders need to develop their capabilities to try out new things and recognize fast whether it is working for them or not. In addition, they need to delegate their powers to reap the best out of DT. Moreover, they need the ability to manage diverse teams, as DT brings different functions and stakeholders to the same platforms to work together for the best outcome of their organization. Based on the identified leadership competencies, we argue that these will

help industrial organizations to develop their leadership, accordingly, enabling them to secure impactful DT. Moreover, to enhance the generalizability of these results, we recommend that future research includes more case organizations as well as interview participants.

References

1. Smet, A.D., Lurie, M., George, A.S.: Leading Agile Transformation: The New Capabilities Leaders Need to Build 21st-century Organizations, p. 27. McKinsey Co. (2018)
2. Agarwal, R., Johnson, S.L., Lucas, H.C.: Leadership in the face of technological discontinuities: the transformation of EarthColor. Commun. Assoc. Inf. Syst. **29**, 33 (2018)
3. Gilchrist, A.: Industry 4.0: The Industrial Internet of Things. Apress, Bangkok (2016)
4. Hess, T.: Understanding digital transformation strategy formation: insights from transformation strategy formation: insights from Europe's automotive industry (2019)
5. Vial, G.: Understanding digital transformation: a review and a research agenda. J. Strateg. Inf. Syst. **28**(2), 118–144 (2019)
6. Kane, G.C., Phillips, A.N., Copulsky, J., Andrus, G.: How digital leadership is(n't) different: leaders must blend traditional and new skills to effectively guide their organizations into the future. MIT Sloan Manag. Rev. **60**(3), 34–39 (2019)
7. Das, A., Kumar, V., Kumar, U.: The role of leadership competencies for implementing TQM: An empirical study in Thai manufacturing industry. Int. J. Qual. Reliab. Manag. **28**(2), 195–219 (2011)
8. Gebelein, S.H.: Leadership competency. Leadersh. Excell. **18**(3), 10 (2001)
9. Imran, F., Kantola, J.: Review of industry 4.0 in the light of sociotechnical system theory and competence-based view: a future research agenda for the evolute approach. Adv. Intell. Syst. Comput. **783**, 118–128 (2018)
10. Sainger, G.: Leadership in digital age: a study on the role of leader in this era of digital transformation. Int. J. Leadersh. **6**(1), 1–6 (2018)
11. Singh, A., Hess, T.: How chief digital officers promote the digital transformation of their companies. MIS Q. Exec. **16**(2), 1–17 (2017)
12. Mumford, E.: A socio-technical approach to systems design. Requir. Eng. **5**(2), 125–133 (2000)
13. Barone, G.: Being a smart leader in the digital age, pp. 16–18 (2019)
14. Loebbecke, C., Picot, A.: Reflections on societal and business model transformation arising from digitization and big data analytics: a research agenda. J. Strateg. Inf. Syst. **24**(3), 149–157 (2015)
15. Reck, F., Fliaster, A.: Four profiles of successful digital executives four types of effective digital executives in business organizations. MIT Sloan Mgt. Rev. **60**, 1–7 (2019)
16. Wade, M., Obwegeser, N.: How to choose the right digital leader for your company". MIT Sloan Manag. Rev. **60**, 1–4 (2019)
17. Eisenhardt, K.M.: Building theories from case study research. Acad. Manag. Rev. **14**(4), 532–550 (1989)
18. Matthews, B., Ross, L.: Research Methods. A Practical Guide for the Social Sciences. Pearson Longman, Harlow (2010)
19. Hesse, A.: Digitalization and leadership - how experienced leaders interpret daily realities in a digital world. In: Proceedings of 51st Hawaii International Conference on System Science (2018)
20. Yin, R.: Case Study Research: Design and Methods. Sage Publications, London (2003)

21. Huberman, A., Miles, M., Janet Ward, S.: Increasing the generalizability of qualitative research. Ín: The Qualitative Researcher's Companion (2012)
22. Gioia, D.A., Corley, K.G., Hamilton, A.L.: Seeking qualitative rigor in inductive research: notes on the gioia methodology. Organ. Res. Methods **16**(1), 15–31 (2013)
23. Larjovuori, R.L., Bordi, L., Heikkilä-Tammi, K.: Leadership in the digital business transformation. In: ACM International Conference on Proceeding of Series, pp. 212–221 (2018)
24. Fitzgerald, M., Kruschwitz, N., Bonnet, D., Welch, M.: Embracing digital technology: a new strategic imperative—Capgemini consulting worldwide. MIT Sloan Manag. Rev. **55**(1), 1–13 (2013)
25. Petrucci, T., Rivera, M.: Leading growth through the digital leader. J. Leadersh. Stud. **12**(3), 53–56 (2018)
26. Colbert, A., Yee, N., George, G.: The digital workforce and the workplace of the future. Acad. Manag. J. **59**(3), 731–739 (2016)
27. Khanna, R., Guler, I., Nerkar, A.: Fail often, fail big, and fail fast? Learning from small failures and R&D performance in the pharmaceutical industry. Acad. Manag. J. **59**(2), 436–459 (2016)
28. Friend, S.B., Ranjan, K.R., Johnson, J.S.: Fail fast, sell well: the contingent impact of failing fast on salesperson performance. Ind. Mark. Manag. **82**, 265–275 (2019)
29. Ahearne, M., Mathieu, J., Rapp, A.: To empower or not to empower your sales force? An empirical examination of the influence of leadership empowerment behavior on customer satisfaction and performance. J. Appl. Psychol. **90**(5), 945–955 (2005)
30. Sebastian, I.M., Mocker, M., Ross, J.W., Moloney, K.G., Beath, C., Fonstad, N.O.: How big old companies navigate digital transformation. MIS Q. Exec. **16**(3), 197–213 (2017)
31. Schwarzmüller, T., Brosi, P., Duman, D., Welpe, I.M.: How does the digital transformation affect organizations? Key themes of change in work design and leadership. Manag. Revue **29**(2), 114–138 (2018)

A Scientific Guidance to Welfare Planning with System Dynamics Modeling

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Abstract. The public discussion towards abortion policy in Alabama triggered research interest from many prestige scholars to revisit the often-polarized topic. Our research focus on exploring the implication using the policy change as an external perturbation raising attention to the existing diseases conditions causing infant morbidity and mortality, e.g. HIV and STI, providing an alternative perspective through System Dynamics Modeling to illustrate the practical problems and propose possible solutions to achieve effective governance. The existence and response tackling transmittable diseases pose challenges in providing consistent quality medical care and increasing burden in the context of heath sector development. Taking into the consideration of limited public sector resources with many competing areas for spending and investment, the importance to prioritize based on need and relative challenges becomes the determinant factor to effective policy decision making process. This paper begins with a review of previous relevant experiment in system dynamics concerning public health, then it presents a functional model designed to include existing conditions of transmittable disease (HIV and STI) in a population and medical financial burden for families. Although our model encompasses a detailed process including the potential policy change in Alabama, our focus in on the connection between disease cases in infant to overall public welfare, which are responsible for the majority of health impairment in the U.S.

Keywords: System Dynamics (SD) · Public health · Social welfare · Agent based modeling · Risk mitigation · Social learning

1 Introduction

Despite remarkable success in some areas, the health sector in American still faces difficult challenges in combating transmittable disease control and meeting its primary objective of reducing the burden of public welfare. Historically, national public health objectives have set and defined numeric targets for reductions in most major health problems, as well as for increases in prevalence of health-promoting behaviors, however, these measurements are often set with high expectations and do not convey meaningful referents for assessing progress. Examples include the number of infants born with

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perinatal HIV, the growth of underinsured population, the long lasting ethnical and/or geographical health disparities, and the overall decline in health-related quality of life. In addition, the underlying causal relationships among these issues have created additional layer of complexity preventing officials in finding effective immediate solutions.

In the past decade, United States have continued its success as a global leader in medical research, technology advancement, and economic growth. From an overall perspective, U.S government has alleviated overall poverty level, child mortality and education inequality aligning its development goals to better allocate necessary resources. At the first glance, the decreasing numbers present a promising outlook, however, geographical differences between cities reveals the factors complicating the issues including medical resources access, disease prevention and social welfare budget planning for household in severe poverty. Although economic growth serves as a key indicator towards a country's wellbeing, the measurement does not provide a full picture of the quality of economic activity nor does it consider the citizens who benefits, more importantly those who are left out or left behind. Our case study city Alabama has recently become the center of policy discussion; we believe that there are challenges embedded within Alabama's existing system which interconnect with risk factors, disease and limited health care resource in a continuous state of interaction leading to disparities in health status over the past years that deserve our immediate attention.

2 Application of System Dynamics (SD) in Public Health

Scholars have long been exploring the right balance between providing governance to serve the needs of the citizens and executing the planned process to delivery expected results in healthcare practices through government funded social welfare programs. Traditionally, researchers have placed focus on benefits from information technology to improve healthcare analytics. Nevertheless, critics express their concerns in public health intervention falling short from missing the conceptual wholistic perspective and inability in addressing efficient and accurately pinpoint strategic change process. The dynamic complexity in the healthcare system stem from long delays between causes and effects, and by multiple stakeholders' interest and goals that may conflict with one another. The underlying complexity results from the interaction among individual, organizational and government creating feedback mechanism. Since 1970s, researchers have started utilizing system dynamics simulation modeling as primary methodology in a variety of health priority areas, including chronic diseases and opportunities to improve public health [1–3]. Specifically, the researchers emphasize the challenges in the lack of linkages between the healthcare system and other community agencies that should be involved.

This paper illustrates the simplified process linking three key areas: birth population, infant disease cases, and total government welfare, then adding factors that cause the change in parameters for each focus area. The dynamic flow diagram represents an equation-based model including functions using rate of change, simulate over finite amount of investigate period, empirical results reveal interconnected relationship and overall behavior change across the three areas. These changes monitored through our simulation process shed light to the complex healthcare system, present a value-added

solution through a scientific approach. Sensitivity analysis is conducted to assess risk and relative dependency between percentage of transmittable disease and the percentage of social welfare covered by public insurance. The goal of our research aims to adopt systems thinking using abortion policy lever as a critical component in investigate changes between short- and long-term decision-making processes.

Because the health of the citizens and the overall welfare spending budget display a reciprocally connected relationship, we believe that the notion of effective governance goes require analysis to advance beyond traditional policy mechanisms of government and refers to the totality of welfare needed in ensuring wellness for all. By using differential equations in System Dynamics Modeling, we capture the nonlinear behavior change between the number of infant disease cases and the amount of welfare budget needed. From a short-term perspective with abortion policy in effect in 2020, our simulation results indicate a 26% increase in the cases of infant born pre-exposed with HIV and STI, in turn there is a 2.2% increase in welfare spending. Alternatively, from a causality standpoint, we observe a drastic difference in trend for the two defined time lengths. The research results are valuable in identifying opportunities for temporal calibration, increasing fidelity to model assessment, and further providing scientific guidance for policy-oriented decisions.

3 A State-Level Operational Model

3.1 Model Design and Scope

The existence and response tackling transmittable diseases pose challenges in providing consistent quality medical care and increasing burden in the context of heath sector development. Taking into the consideration of limited public sector resources with various competing areas for spending and investment, the importance to prioritize based on need and relative challenges becomes the determinant factor to effective policy decision making process.

System dynamics is a rigorous systematic modeling methodology that allow us to build and design formal computer simulations of complex interactions of individual processes and organization levels to add value in evaluating change and planning for action. In this paper, we propose using Fourth Order Runge-Kutta (RK4), a time stepper to solve the differential equations. Key variables are extracted from reliable data sources, Alabama Vital Statistics in 2015 and Stats of the State of Alabama, that we include in the model as initial conditions (Table 1).

3.2 Model Stocks and Flows

The simplified process (Fig. 1) mapping demonstrating linkage between regulatory policy to number of children with detectable diseases needing monetary support.

1. Stock 1 (Number of birth): The first stock is a number of birth. We definite the number of birth as the amount of birth flow in the stock and the flow out as a number of aborted pregnancies. The control variables are abortion rate and the birth rate

Table 1. Key variables used in SD simulation modeling

Initial condition for simulation period 2010–2030	
Birth rate	12.3%
Number of birth	$59,651
Abortion rate	9.0%
HIV	0.6%
STI	0.3%
Infant mortality rate	8.3%
Failed to complete prenatal detection	35.60%
Budget covered by public insurance	6.1%
Total public funding (million)	$137.00

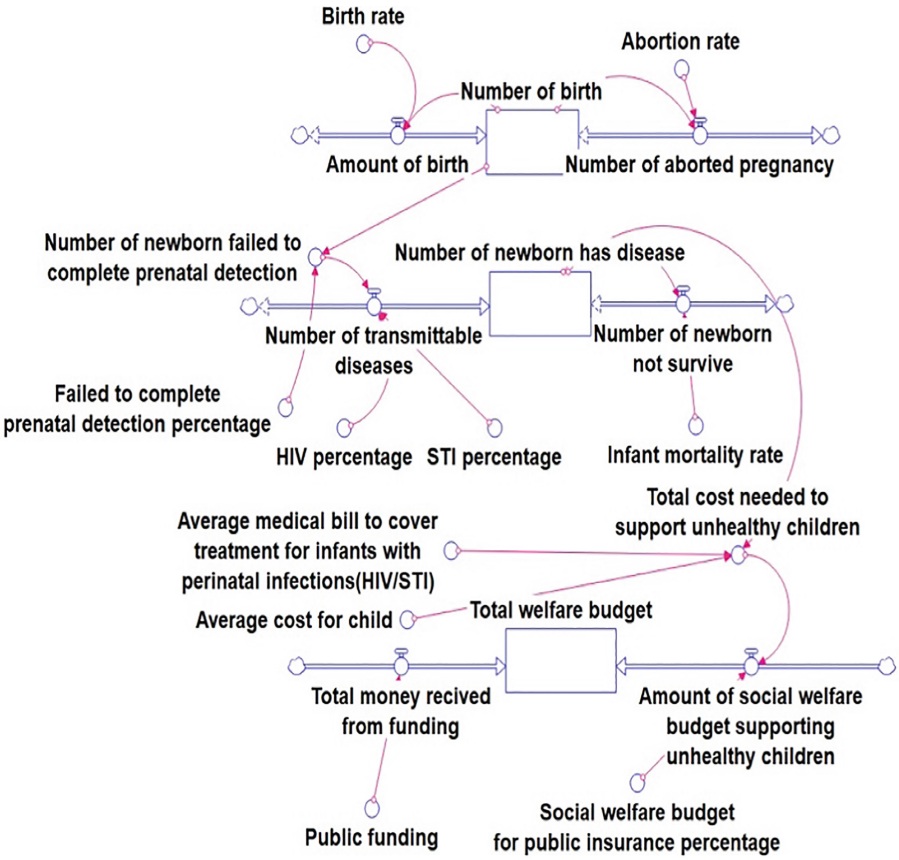

Fig. 1. Causal framework of the system dynamics model

which controlling the newborn numbers. Here we consider natural growth rate, not social increase rate since the social increase rate will include net migration and international migration which is more complicated also it is not the main focusing we would want to observe.

2. Stock 2 (Number newborn has disease): The stock 2 is a number of the newborn has a disease which we consider the number of transmittable disease flow in and a number of a newborn do not survive as flow out, also we use the number of birth connect stock 1 to stock 2. In addition, the number of a number of transmittable diseases including number of newborns failed to complete prenatal detection with a newborn of HIV and STI percentage. We assume if the pregnancies do not complete prenatal detection, there might be a higher chance of newborn has diseases. The flow out, the number of newborns, not survive would be a number of a newborn has disease * infant mortality rate.
3. Stock 3 (Total welfare budget): The stock 1 and 2 we consider the newborn population and stock 3 we would connect to the social welfare budget and see how newborns with disease influence the government budget. Therefore, the third stock is the total welfare budget equal to the total money received from finding as flow in and amount of social welfare budget supporting unhealthy children as flow out. We use public funding as the money received from funding; the amount of social welfare budget supporting unhealthy children as total cost needs to support unhealthy children. We assume the money for supporting unhealthy children as the average medical bills to cover treatment for infants with the perinatal infection which the disease HIV and STI, and average children spending.

3.3 Differential Equations

Our system dynamic framework provide a rigorous means of thinking about and describing the complex social public health network and its interaction with transmittable diseases among infants and social spending. Using differential equations, we then are able to model the non-linear interactions among three key variables: number of newborn, number of newborns with disease and welfare budget. The differential equations describe as below:

$$\begin{cases} \frac{dB}{dt} = \alpha B - \beta(B * A) & (1) \\ \frac{dD}{dt} = \gamma B(d + f) - \sigma[(M + P) + (SW * S)] & (2) \\ \frac{dW}{dt} = \delta W - \rho(D * M) & (3) \end{cases}$$

A = Abortion rate
B = Number of birth
d = disease (%)
D = Number of newborn with disease
f = Failed prenatal screening (%)
M = Average cost for medical treatment
P = Public funding
SW = Social welfare budget
S = Government support (tax)
W = Total welfare budget

4 Experiment Results

In this section, we will discuss the results from two designed comparison; first, we explain the baseline (abortion rate is 9%) scenario, compare and contrast the results with our simulation result when abortion rate is 0%. Second, we are curious to examine the differences between short-term (20 years) and long-term (50 years) perspective for the number of disease cases among newborns and the total spend for social welfare.

4.1 Baseline vs. Simulation

Figure 2 and 3 are the simulation results visually represents when abortion rate decrease from 9% to 0%, the change can lead to an 26% increase of newborn with disease cases and a 2.2% increase need to be added to the total social welfare budget. Overall, the number of newborns declines. In baseline scenario, represented in the solid black line, as time increases, the number of newborn with disease decreases. On the other hand, the simulated scenario, which is illustrated in green, the disease case number is now in concave shaped after year 2022 (Fig. 2). In Fig. 3, we connect the previous results systematically to the social welfare level to demonstrate the differences in spending under these two designed experiments. Interestingly, for both baseline and simulation results, the amount of total welfare spending is extremely similar and is positively increasing by year. Based on our scientific framework when using abortion rate as change lever in a systematic process, we can conclude that the differences for total spend in social welfare appear to be minimal. However, the obvious difference is the pattern for the number of infant born with diseases. Evidentially, we can conclude that there is a correlation exists between the number of unhealthy infant and social welfare spending.

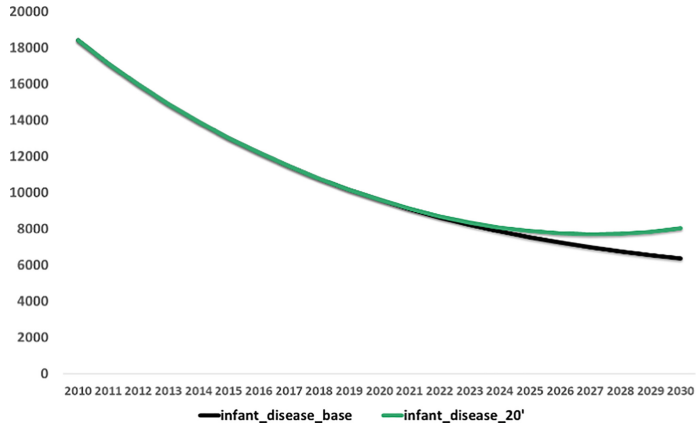

Fig. 2. Number of newborn with disease - 20 years

4.2 Short Term vs. Long Term

Next, we seek to uncover controlled variables impact between the short and long term. From Fig. 4, we identify that there is a similar pattern before 20 years. From a long term

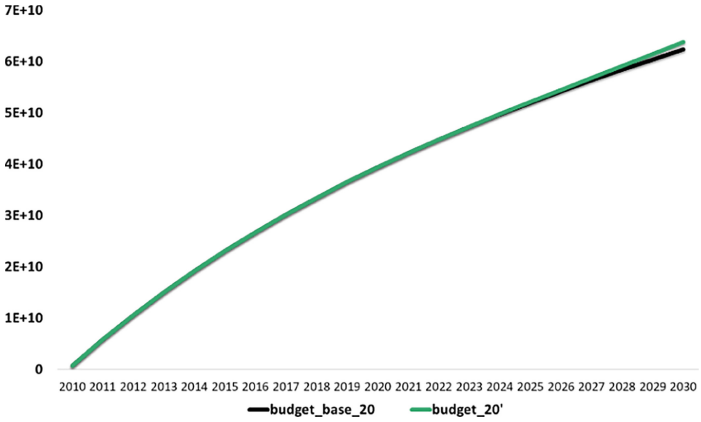

Fig. 3. Total welfare budget - 20 years

trajectory standpoint, the curve displays a concave shape with the lowest number for the newborn with a disease in the year 2035, later the number slowly increases.

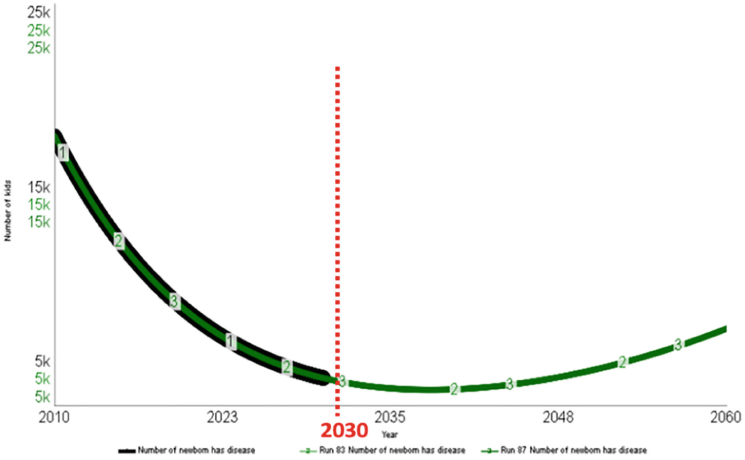

Fig. 4. Number of newborn with disease (in long/short term)

In Fig. 5, we illustrate the apparent different pattern for the social welfare budget in the comparison between short and long run. From a short term perspective, which in this case is defined as 20 years, the steep tangent represent a higher spend in total social welfare. Alternatively, under the long run (50 years), the increase is spread overtime and at a lower tangent slope.

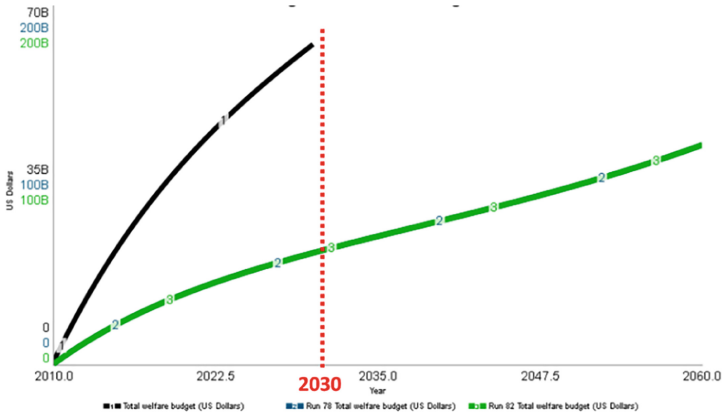

Fig. 5. Total welfare budget (in long/short term)

5 Two-Factor Sensitivity Analysis

Incorporating existing condition as change-lever two variable heap map allow us to use the change between percentage of transmittable disease and the percentage of social welfare covered by public insurance displaying two preferential ranges (shown in green) that lead to negative impact to total welfare budget suggesting a decrease in government financial burden (Table 2).

Table 2. Two-factor sensitivity analysis

15,057	-30%	-20%	-10%	0%	10%	20%	30%
-30%	24596	16443	8290	137	-8016	-16169	-24322
-20%	16443	11008	5572	137	-5298	-10734	-16169
-10%	8290	5572	2855	137	-2581	-5298	-8016
0%	137	137	137	137	137	137	137
10%	-8016	-5298	-2581	137	2855	5572	8290
20%	-16169	-10734	-5298	137	5572	11008	16443
30%	-24322	-16169	-8016	137	8290	16443	24596

Total welfare budget (in millions)

6 Conclusions

Success in connecting disease and the large-scale public health network has been over due, in part, to the availability of data to accurately capture the interaction among different individuals, organizations and agencies. Our proposed system dynamic framework shed light on the possibility in expanding to produce valid results and serves as a pilot study in the field. The designed experiments have produced valuable insights that we may

be able to further investigate, i.e. the inclusion of effects of individuals with public or private health insurance coverage, urban rural gap and medical resources available for prenatal care. System-based thinking and simulation have allowed us to create scenario comparison in understanding the effect of disease cases to budget for social expenditure. Based on our experiment, an increasing number infant born with transmittable diseases has a larger consequence to social budget in the short run (20 years). In fact, over time (50 years), the outcome is scientifically smoothed out. Another interesting insight is the ability to use policy change as a lever to estimate potential outcomes as we did with the abortion rate. SD modeling technique proves to be complementary to policy implementation and for risk mitigation, and the success of our experiment is a great start to push for collaboration among academia, governance and cooperation to use simulation as a mean to provide policy calibration and long term risk management.

References

1. Loyo, H.K., Batcher, C., Wile, K., Huang, P., Orenstein, D., Milstein, B.: From model to action: using a system dynamics model of chronic disease risks to align community action. Health Promot. Pract. **14**(1), 53–61 (2013)
2. Homer, J., Hirsch, G., Milstein, B.: Chronic illness in a complex health economy: the perils and promises of downstream and upstream reforms. Syst. Dyn. Rev.: J. Syst. Dyn. Soc. **23**(2–3), 313–343 (2007)
3. Homer, J.B., Hirsch, G.B.: System dynamics modeling for public health: background and opportunities. Am. J. Public Health **96**(3), 452–458 (2006)

Social Capital: Theory, Principles and Value Boarding for a Potential Deep Transition for the Mexican Artisan Sector

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Abstract. The knowledge and the links between participants are two basic elements that allow the development and survival of sectors that, like the artisan one, find in the endogenous knowledge the central motor for the production of goods. For that reason this article seeks to synthesize concepts and key definitions of social capital with the purpose of making evident to the reader its relevance for the study of the phenomena that surround this group, especially when it is sought to generate a complex approach that seeks the development of deep transformations on their issues. Based on the analysis of research articles that allow us to understand the value of this capital and of diverse methodologies focused on promoting its development, relevant findings are defined within the State of Art and evidencing different lines of study that will allow related researchers to find a theoretical and methodological reference for the development of their projects.

Keywords: Social capital · Artisan sector · Link · Deep transitions

1 Introduction. General Theoretical Concepts, Origins and Relevance of Social Capital

In the scope of the economic theory, the point of convergence between antagonistic positions such as those of Karl Marx and Adam Smith is given around the concept of capital as an asset capable of generating profits and wealth allowing the production of goods and services that generate value (benefits) on the basis of work. While Marx stresses that wealth emanates from the capital generated from the dominant exploitation between the owners of the productive assets and the worker, Smith includes, in his conception of capital, the integration of the skills obtained from the individuals involved, such as knowledge, talent and experience [1]. Although the organizational nature that allows the production of goods, both in theory and in practice, naturally considers a relationalist approach between the human factor, the cognitive, the structural and the material, creating processes that are integrated by the continuous interaction of these, both in an automated approach and in that of an artisan nature. For this reason, Rickap [2] highlights Karl Marx's remark on the inherent need for capital to generate an imposition on the competitive arena by means of technical transformations that promote additional

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income for the supply of goods. That is to say, these innovations - transformations - allow the competitive validity within the markets. For Polanyi [3] one of the central flaws in the self-regulating market theses of Smith and other liberalists such as Ricardo, Malthus, Burke and Betham, is that they determine that economic factors of production such as land, labor and capital cannot - or should be seen - as commodities which, in practice, are determined as a fallacy as they all eventually become commodities.

Since Nonaka's works (1994), tacit knowledge has been highlighted as a basic element for the development of latent innovations not only in tangible and intangible goods and merchandise but also in the processes that allow improvements in production [4]. This emphasis on knowledge also considers the capacity of management, transfer and adoption under the rationale that knowledge is conceived as an inherent asset of the individuals involved in the productive processes. A value that is difficult to replicate largely because of its broadly changing nature and requirement not only of that which comes from formality but of that which is built with experience itself, making it a commodity of trade. This, together with the complex approach based on the General Theory of Systems developed by Ludwing Von Bertanlaffy in 1969 and considered by a considerable volume of researchers, allows us to understand the value of the complex network and the relational capacity of organizations which (as living and changing cells) must be built and maintained continuously to develop and establish a natural sense of self-preservation. On the other hand, Arnold and Osorio (1998) establish that this theory considers that the connections between the involved participants are key resources of the development of an adequate system that allows to generate a structure that impels its sense of survival and to develop, from it, value, same that emanates of the Interrelation and effective communication between participants promoting with it the transfer and adoption of knowledge of the involved members [5]. It is these connections that allow companies, groups and units to manage dynamic capacities that enable them to remain within the competitive and exchange markets to which they belong. It is precisely this dynamic sense that allows organizations to find a sense of flexibility and continuous adaptation from the cyclical learning, the adoption of rules that support the structure and the relational strength of its members [6].

In the year 2000 Durston for the Social Development Division of the Economic Commission for Latin America and the Caribbean of the United Nations (ECLAC), established that the **social concept** began to show a leading tendency from the 1980 s onwards, integrating interdisciplinary knowledge and generating a discussion in its approach as a theory or as a paradigm. This publication [7] conceives three basic aspects: the sense of trust, mutual assistance and cooperation. While Putman and Grossm point out that this concept was first addressed in 1916 by L. H. Hanifan, and that today it can find more complex considerations, in its essence it is recognized as intangible emanating from the daily life of social individuals being defined by the sense of solidarity and comradeship between subjects and their close groups. Therefore, social capital can be defined under two visions: the cultural and the structural. For Woolcock and Narayan [1] the central difference between the two is that while the structural one conceives it as a resource that allows for a more robust confrontation with crisis and systemic erosion, the cultural one focuses on community values and norms.

The approaches mentioned above, in synchrony with the logic of networks, establish that **social capital** is conceived as that which emanates from the relationships and links that an individual is capable of creating, maintaining and managing without being centered in a unicentric relationship of an ego-actant [8]. Although its development and exploitation means an individual good, it finds in the framework, a development of codes and guidelines considered by the participants integrated in it, so that the exercise of power is negotiated by those involved. Therefore, an ego-participant considers potential and inactive, dormant capacities, which will generate synergic value from their addition to a network [9]. The approach to social capital also considers motivations under psychological and social patterns taking into account the principle of influence and constitution of social dynamics by social and cultural aspects, therefore, its implementations vary with respect to the context that surrounds them [10]. It is for that reason that Ronald Burn retakes the importance of the social position establishing that the **social capital** is "granted" by the hierarchical position that a network grants to a particular individual, beyond the individual relation that is capable of generating a participant in the extent that the relations consider a flow of back and forth, continuous, regarding the communicative demand; otherwise, we would speak of a merely informative flow. Therefore, it is also relevant to consider its nature: cyclical or self-transactional in order to determine whether there is a halo of integration or a pragmatic one [11].

In line with the above, Arriaga [12] generates a melting pot that researchers should consider when showing the possibilities of a theoretical approach based on social capital regarding its nature, development, maintenance, erosion and evolution from the requirements and nature of social absorption such as mechanical solidarity, class awareness regarding the roles and hierarchical position that the members of a group hold, as well as the initial condition and emerging capabilities of social action, all under a sociological approach [10]. The anthropological perspective is also considered insofar as it allows for the generation of an analysis of social organization with respect to the structural definition and the emergence or decline of institutional entities, as well as the logic of reciprocal exchanges for its maintenance based on the tacit and/or implicit adoption of the dialogue contracts that make possible agreements and capacities of social direction. Thus, **social capital** considers a series of basic principles based on four fundamental elements: **shared knowledge**, such as the capacity to have a cognitive asset and to promote the capacity to transfer it to other members of the group, thus reinforcing a synergy and added value to the initial stage of said cognitive asset. The **values and norms** defined in the groups and that are a reflection of the base structure or scope in which they are developed, consider central variables in the capacities of how social capital is obtained, integrated, constructed or inherited. Finally, there are the **existing agreements** and the **social network** already pre-existing prior to an approach of social science.

Anthropological and sociological approaches meet theoretical principles developed by personalities such as Emile Durkheim, Karl Marx, Max Weber, Raymond Firth, Marcel Mauss and George Foster. As it can be seen in Fig. 1, these established contributions to the theoretical study of this phenomenon including key concepts that go from the social network, social integration, access to new realities hand in hand with the linkage and technology, as well as the relevance of the rules and tacit and explicit norms that integrate and direct the social context.

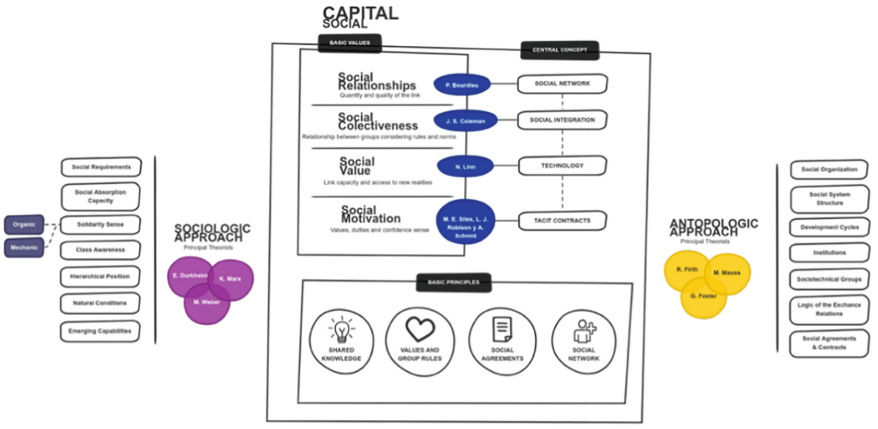

Fig. 1. Social Capital Principles, Values, Authors and Approaches. This figure shows the relationship between the basic values of social capital that the theorist have worked on the phenomena and four central concepts that drives the basic principles of it, mentioned in the work of the revised authors. Also, it integrates the two approaches mentioned in the text below. The Fig. 1 was created by the author with information of Arriaga (2003) [12] and Capella (2017) [13].

2 The Artisan Sector in Mexico: Reality and Relevance of Research Approach

It is established that the artisan sector faces a series of problems and threats that affect the survival of its work in the production of cultural goods, which is why the sector is usually considered in programs that address the fight against poverty. This fight began, according to data provided by various authors [14] in 1990 with the National Solidarity Program (Pronasol), which has changed its name over the six years of the executive branch, in response to the interests set forth in the various government plans promoted to date. Pronasol is mentioned because this program sought to promote the development of indigenous and rural communities, specifically by addressing the artisan sector.

In Mexico, this sector stands out not only because of the value perceived in the cultural capital but also because of the demographics it includes (in its last record published in 2015 it considered a total population of 12 million people, or 10% of the total population considered in the last population census of the National Institute of Statistics and Geography (INEGI)) [15]. Likewise, according to data from the National Promotion for the Development of Arts and Crafts (FONART) in 2017 [16], we find that Artisan Sector activity generates 20.3% of the GDP in the cultural sector and 3.8% related to tourism activity (INEGI 2018) [17], making it the third most important country in the world with regard to the development of such activity. The INEGI (2018) [17] established that it contributed 13% of the total GDP.

Although its economic relevance has been stated, within the sector's approach it is clear that it is continuously facing a series of failures that have threatened its sense of sustainability and stability. Likewise, it is emphasized that the development of this and other similar sectors depends to a great extent on a systemic approach that allows for the understanding of group dynamics and the establishment of a structural definition of the

socio-technical systems in which they are embedded in order to define an approach that allows for a holistic vision of the problems and the development of niche projects that promote structural changes in favor of these sectors [18]. For example, in Mexico most of the artisan producers are under an informal scheme, which does not imply that there is no defined organizational structure or that they are dispersed ego-participants; on the contrary, due to the nature of their activity they have forged productive organizations that allow them to develop their diligence (although it would be necessary to go deeper into the different existing organizational schemes, for the purposes of this article only the general systemic logic of the sector is highlighted). In the artisan sector, a general organization is detected, forged from family groups and/or local members that integrate productive groups, usually directed by leaders, who guide and make decisions based on their experience, which is generated from their social hierarchy within the group. According to De la Paz Hernandez Giron, Yescas Leon and Dominguez Hernandez [19], the structure of this type of organization can be extremely flexible, varying according to its experience, members and context, and with the capacity to adapt to its environment largely due to the sense of solidarity and value of the relationships among its members. In order to understand how a sector operates in reality, an interview was conducted with Héctor Montes [20], owner of the exploitation concession of the Opal Libertad Mine. In this interview, the artisan referred to the way in which the mine is operated, pointing out that those involved in it are family and friends who exploit, sell raw materials, produce pieces, carry out direct sales, supply intermediaries and manage/operate tourist visits to the mine in such a way that the income from exchange is diversified and reduces the sense of dependence on a single activity. Through the interview the artisan shows the relevance of the agreements and the relationship between the participants who collaborate in the network of local opal craftsmen. The creation of groups, associations and clusters is a common practice in the development of artisan products and goods. In this regard, researchers such as Abeledo Sanchis, Coll Serrano and Raussel Köster [21], have shown in their research that this allows to strengthen the sector from the concentration, the linkage and the development of social capital of craft groups with the ability to manage innovation and sense of specialization, which gives them a greater sense of survival. The authors also assert that part of the flaws stem from a sense of informality and limited access to formal education. In this sense, Arriaga Baidal, et al. [22] have documented the successful case of the integration of academic knowledge and endogenous knowledge present in artisan production. In the case mentioned, it is highlighted that the integration and linkage allowed the development and adoption of administrative technology to cover a latent flaw in a community of furniture producers: the price strategy. Among the cases it is established that the respect to the defined rules of social interaction and the definition of clear objectives allow that the academic knowledge achieves an adoption of value to the empirical practice of the artisan.

In the published investigations and considered for the revision of the State of Art in relation to the variables social capital and artisan sector they emphasize the value of the first one as a key action not only for the natural operation of the economic units developed by artisan producers but as a way with the capacity to transform the failures of the sector in their own benefit, especially if one follows the Deep Transformation Theory approach developed by Schot and Kanger [18] evident in cases such as *Honeybee's*

Network [23] in which the integration of knowledge and linkage between researchers, scientists and artisans create a *grassroots* development gap by triggering the economic development of vulnerable groups and the production of low-cost artisanal products with a continuous focus on innovation without falling back on social, economic and technological colonization by naturally integrating resources and skills.

Researchers around the world continuously publish cases in which, through the principles of social capital and solidarity, they promote the development of niches for the solution and deep transformation of systems, thus demonstrating that the community approach can generate solutions to social and economic development problems in diverse contexts.

3 Social Capital at Artisan's Sector: State of Art

In order to determine the validity of the theoretical framework and the approaches developed by researchers from different regions regarding the relationship between the social capital and artisan sector variables, we found ten research papers published in the last eighteen years. In them, one of the central approaches is the institutional integration, because the social dynamics and the participants involved are central elements for the approach of value transformations within the artisan spectrum. For Dhesi [24], this reasoning is evident and is reflected in a case study and phenomenological documentation in which he manages to document a project in which, after 30 years, a neuralgic change in the dynamics and development of the artisan sector is achieved. As in the theory of social capital in the case of Dhesi Village in India, it is also considered central to understand the complexity of social and group dynamics, in which power relations under a Foucauldian view are not uncommon.

On the other hand, in a comparison of cases of analysis of the artisan sector in Latin America (LATAM Portes and Landolt) [25], they point out that 'unexpected' consequences can arise. It also states that it should not be lost sight of the fact that there is also a side of the phenomenon that has not been highlighted by other researchers, namely the non-positive effects of group management, such as: exclusion of outsiders; the demand for contributions from members based on group pressure; the restriction of individual freedoms and the erosion of primary rules. These dynamics were documented based on the analysis of three empirical cases that took place in this region, allowing to establish that the drive of the companies of the artisan sector emanates from two ways that are part of the moral commitments and of belonging of the groups: the altruistic forces that provide status and sense of loyalty in a first instance and generally seen in groups with a high sense of identity and integration and, on the other hand, the support from the sense of solidarity. This approach, which is more sociological than structural, makes it possible to determine the constant presence of social theories for both development and exclusion. The above in synchrony with the cellular nature of the work of the unions that together with the importance of the representations of a leader establishes a logical sense supported by the revised authors: the consideration of the norms and natural or endogenous dynamics of each group.

Regarding the development of a natural integration Gupta, *et al.* [23] support the importance of creating solidarity links between local production groups and the

academia, not under a halo of colonization but based on the principles of integration, polycentrism and segmentation, thus empowering the creative forces of societies, which eventually leads to develop a synergy that promotes integrated innovation between informal and endogenous knowledge. Unlike Portes and Landolt [25], Gupta, *et al*. [23] establish a more positive approach to the integration of noncommunity participants. In a critical view, this difference may be largely due to the methodology applied, since while the latter document cases in parallel they develop them, which allows them to shape the dynamics to advance the objectives of *grassroots* implementation.

In turn, Abeledo Sanchis, Coll Serrano and Raussel Köster [21] focused their research on cluster analysis, seeking to prove a key thesis that highlights the value of social capital in the sector of interest, showing that the greater the integration, the greater the capacity for innovation. However, this analysis should be added to the importance of the integration of constant advice on the administrative and market operations that contributed to the development of the groups within the case reviewed by these authors.

Although in the case of *Honeybee's Network*, innovation, technology adoption and the development of synergistic knowledge are mentioned as important for the development of the artisan sector, it is through Baidal, *et al*. [22] that a process failure in the commercial activities of the furniture sector is integrated with software that allows for the solution of price definition failures by developing a knowledge base that allows for technology adoption. In this work, the researchers undertook the task of generating a qualitative survey that would allow them to define the relevance and incidence of the failure and subsequently establish a quantitative survey that would allow them to determine the results and monitor the evolution. Within the technological adoption, almost a decade before, Ahmed [27] postulated that information technologies beyond limiting and contracting social capital, should -especially with the boom of the Internet and digital platforms- be considered windows for the development of a more extensive social capital and a faster way for the integration, linkage and transfer of knowledge (considering the capacity of synergy from co-creation); thus technologies are perceived as a tool that could allow the systemic development of groups. Under the revised assumptions and theoretical principles of social capital, especially under the approach of Gupta, *et al*. In addition to the above, Bonilla Marchan, Delgado and Stefos [28] contributed an approach that could be key to planning projects that seek to promote the development of the artisanal sector. Based on a multi-dimensional statistical analysis, they generated seven clusters which, based on the demographics, profiled Ecuadorian artisans, thereby promoting the definition of basic characteristics that could be considered a basic preamble for effective outreach between external participants to the group in question. In this regard, other authors such as Capella [12] highlight the importance of the sense of identity, a factor that may contain the possibility of exercising a cognitive or technological colonization approach. Capella [12] also emphasizes that in order to define development policies and plans it is necessary to consider the following identification factors: historical memory, valuation and use of language, influential social participants and the situation with respect to the people, the poverty they live in and their ethnic identity, focusing on establishing information regarding three key areas: the sources of social capital; the components of social capital; and the definition of a methodology for approaching the context.

Finally, Manfredi Latilla, et al. [29] develop an analysis of scientific production regarding knowledge transfer within the creative industries and within their findings, despite the development of successful cases that seek to move away from a colonizing approach, they discover that by 2018 there was not a relevant volume of articles that managed to address knowledge transfer in the sector while respecting the original structure. Instead, they postulated proposals for the assisted transformation of technology and industrialization of processes. Likewise, within their analysis they establish that due to the nature of the artisanal sector it would be necessary to focus on the construction of a synergy between traditional knowledge and the sense of innovation, something previously defined by the authors reviewed as of the year 2000. Such synergy is relevant to a great extent because it is precisely the endogenous knowledge that allows the development of value and competitive advantage.

Figure 2 synthesizes the approaches and central lines of the authors reviewed, defining their approach to social capital within its application in the artisan sector:

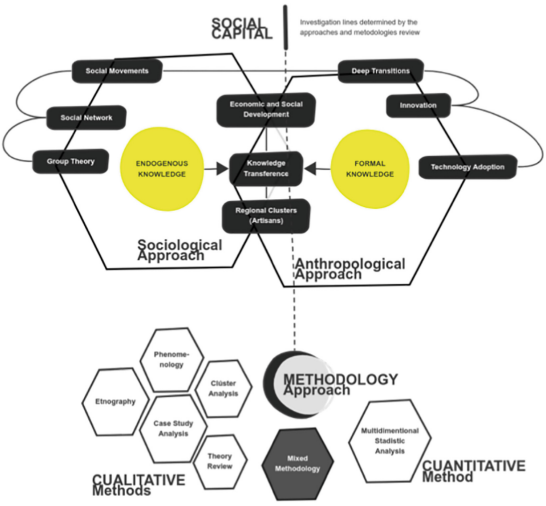

Fig. 2. Central lines of research in addressing social capital phenomena within the Artisan Sector from 2000 to 2018. Own research with information from Dhesi [24], Portes and Landolt [25], Gupta, et al. [23], Abeledo Sanchis, Coll Serrano and Raussel Köster [21], Arriaga Baidal, et al. [27], Marchan, Delgado and Stefos [28], Capella [12] and Manfredi Latilla, et al.

4 Conclusions and Discussion

Within the evolution and complex approach in social and economic organizations, the ability to develop and exploit the relationships and links of the individuals who make them up allows for an added value to the individual and the organizations to which he or she may belong. Therefore, the approach of social capital since the 1980 s has found a place of interest within the variables and phenomena to be studied not only within

the social sector, but also in the economic sector. Within the analytical review of the authors defined for the purpose of this paper it can be ascertained that the theoretical framework presented by them does not have marked differences among them when citing classic authors ranging from Durkheim, through Marx, Lynn and Coleman. The central differences are found in the melting pot of methodological options that they apply, with a marked preference for the documentation or development of case analyses. Likewise, it is possible to detect works of great value that opt for more complex methodologies such as phenomenological and ethnographic studies. The authors point out aspects of relevance for others to consider in future research such as the value of synergy, integration and the development of local innovations that arise from this association. The definition of profiles as part of the identity requirements in favor of a more natural adoption establishes an active starting point for the development of more effective implementations, findings that could add value for other research related to the artisan sector.

References

1. Garcia Valdecasas-Medina, J.I.: A structural definition of social capital networks. Hispanic Mag. Soc. Netw. Anal. **20**(6), 132–160 (2011)
2. Rikap, C.: Capitalism as a system of power: from money to the differentiation of capital. Philos. Econ. **7**(2), 97–111 (2018)
3. Polanyi, K.: The Great Transformation. Fondo de Cultura Económica, Mexico (2017)
4. Henao-García, E.A., Lozada Barahona, N.E., Arias-Pérez, J.: Link between innovation and tacit knowledge: and integration of research findings. Revista Espacios **38**(54), 8–27 (2017)
5. Garcia Flores, R.F.: An approximation from the theory of systems to the behavior of the social organization. Revista Amauta **32**, 191–203 (2018)
6. Teece, D.J.: Dynamic Capabilities and Strategic Management. Oxford University Press, Great Britain (2009)
7. Durston, J.: 1, What is Community Social Capital? United Nations (UN) CEPAL. Social Development Division 38 (2000)
8. Heeks, R., Stansforth, C.: Understanding e-Government project trajectories from an actor-network perspective. Eur. J. Int. Syst. **16**, 165–177 (2007)
9. Schot, J., Kanger, L.: Deep transitions: emergence, acceleration, stabilization and directionality. Res. Policy **4**, 1045–1059 (2018)
10. Dhesi, A.S.: Social capital and community development. Dev. J. **35**(3), 199–2014 (2000)
11. Lesser, E.L.: Knowledge and social capital. Foundations and applications. Futuros **35**(9), 975–987 (2000)
12. Arriaga, I.: Social capital: analytical potentialities and limitations of a concept. Sociol. Stud. **XXI, 63**, 557–584(2003)
13. Capella, N.: Methodology for the characterization of social capital: the case of the social capital of the pemon people. Revista UTCiencia **4**(2), 71–88 (2017)
14. Correa Garcia, L.A., Gonzalez Alcot, R.: The artisan sector in Mexico and the fight against poverty. Transitare **2**(2), 233–250 (2016)
15. INEGI: Tell me…population: number of inhabitants, Mexico (2015). https://wwwinegi.org.mx/
16. INEGI: Press release. National Survey on the Availability and Use of Information Technology in Homes, Mexico (2017). https://bitly/2mNucRu
17. SEDESOL, FONART and INEGI: Artisans and crafts, an economic perspective. FONART, Mexico (2018). https://www.gob.mx/cms/uploads/attachment/file/330994/ARTESANOS _Y_ARTESANIAS_UNA_PERSPECTIVA_ ECONOMICA.pdf

18. Schot, J., Kanger, L.: Deep transitions: emergence, acceleration, stabilization and directionality. Res. Policy **4**(2018), 1045–1059 (2018)
19. De la Paz Hernandez Girón, J., Yescas Leon, M., Dominguez Hernandez, M.L.: Success factors in the handicraft business in Mexico. Manag. Stud. **23**(104), 77–99 (2007)
20. Montes, H.: Oral interview regarding the operation of the opal Artisan Sector (2019)
21. Abeledo Sanchis, R., Coll Serrano, V., Raussel Köster, P.: Culture as a factor of socio-economic innovation in the rural environment: the case of the artistic crafts cluster of La Citta Europea dei Mestieri d'Arte. Ager: J. Stud. Depopul. Rural Dev. (20), 13–103 (2015)
22. Arriaga Baidal, G., Reyes Tomala, M., Carriel Wang, J., Figueroa Trigero, I.: Interrelation of productivity in the artisan sector and the link with the community: network of artisans of the Atahualpa Parish, Province of Santa Elena, Arlo 2015. Sci. Technol. Mag. UPSE **III**(3), 71–79 (2016)
23. Gupta, A.K., Sinha, R., Koradia, D., Patel, R., Parmar, M., Rohit, P., Vivekanandan, P.: Mobilizing grassroots' technological innovations and traditional knowledge, values and institutions: articulating social and ethical capital. Futures **35**(9), 975–987 (2003)
24. Dhesi, A.S.: Social capital and community development. Commun. Dev. J. **35**(3), 199–214 (2000)
25. Portes, A., Landolt, P.: Social capital: promise and pitfalls of its role in development. J. Latin Am. Stud. **32**(2). 529–547 (2000)
26. Abeledo Sanchis, R. Coll Serrano, V., Raussel Köster, P.: Culture as a factor of socio-economic innovation in the rural environment: the case of the cluster of artisan crafts of La Cita Europea dei Mestieri d'Arte. Ager: J. Stud. Depopul. Rural dev. (20), 13–103 (2015)
27. Ahmed, Z.: Explaining the unpredictability: a social capital perspective on ICT intervention. Int. J. Inf. Manag. **38**(1), 175–186 (2005)
28. Bonilla Marchan, A., Delgado, R., Stefos, E.: A multidimensional statistical analysis of artisans and unskilled workers of ecuador. Rev. Eur. Stud. **9**(2). 237–247 (2017)
29. Manfredi Latilla, V., Frattini, F., Messeni Petruzzelli, A., Berner, M.: Knowledge management, knowledge transfer and organizational performance in the arts and crafts industry: a literature review. J. Knowl. Manag. **22**(6), 1310–1331 (2018)

Tomorrow's Digital Worker: A Critical Review and Agenda for Building Digital Competency Models

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Abstract. In competency management studies, scholars call for the importance of digital savviness to hire, train, and develop new digital workers. Yet, the knowledge about the development of such a competence is still scarce. For this endeavor, we followed a systematic literature review to identify a sample of 103 published scientific articles and book chapters dealing with the development and implementation of competency tools in the past 10 years. To our surprise, our review suggests that the landscape of competency tools is surprisingly obsolete and that contemporary requirements of digitization have not yet been incorporated into updated usable competency tools. Through this review our hope is to provide competency managers and researchers with a framework to advance and upgrade their competency tools to address the gap between existing know how and the needed expertise of the digital world.

Keywords: Competency models · Competency tools · Digital competencies · Digitization · Digital worker · Systematic review

1 Introduction

In the recent times the development and implementation of digital competencies became an important topic within organizations facing the digital transformation. The rapid technological advancement and the increased complexity and changing of customer preferences led to complex situations where the emerging of the new technological opportunities is disruptive, but employees are uncertain on how to handle it and use it in their job [25]. Despite the increasing importance in today's business environment, there is no unitary definition of what digital competencies are, most of the researchers agree in defining digital competencies as the technology-related skills [17] needed to successfully perform in today's business environment. Nevertheless, it is important to specify that with the term competencies we do not only refer to knowledge and skills but also to the ability to fulfill at best the requirements of complex environments and situations utilizing psychosocial resources appropriate to the context and critical thinking [29]. Competency, in this instance, represents an umbrella concept including all aspects that can have an impact on the performance [4] and specifically digital competencies are

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considered as a "set of knowledge, skills, attitudes (thus including abilities, strategies, values and awareness) that are required when using IT and digital media to perform tasks, solve problems, communicate, manage information, collaborate; create and share content, and build knowledge effectively, efficiently, appropriately, critically, creatively, autonomously, flexibly, ethically, reflectively for work, leisure, participation, learning, socializing, consuming, and empowerment" [12, p. 3]. The debate about digital competencies does not regard only the business and organizations but also the educational field. Many studies indeed focus on the digital competencies needed in the educational and teaching field, developing competency frameworks. Nevertheless, this paper will not include this area. In light of this considerations, this paper will focus on the analysis of the available competency models to point out to what extent the implementation of competency models allows to identify competencies needed in the digital era to perform effectively in an organization. By reviewing journals in the field of Business Management and Accounting the present study maps the extant research in competency models implementation, pointing out gaps and improvement areas. According to the criteria set in this analysis, the review considers 103 articles on competency tools, published in scientific journals in the last 10 years. On the basis of the results of this review we provide suggestions about the main issues future research should tackle.

2 Classification of Competency Models

The fast changes in today's organizational environment requires the implementation of more flexible methodologies, able to anticipate and capture new competencies needed rather than describing past behaviors [9]. In this situation, competency models represent a step further to job analysis indeed while job analysis focus on the tasks and the characteristics needed to perform that specific task, the competency models focus on personal characteristics needed to success in a broader role [9]. Furthermore, competency models if deployed in the right manner have the potential to connect individual KSAs (knowledge, skills and abilities) to the organizational strategy [9, 32]. Despite the huge amount of competency-based approaches proposed in the literature, giving a satisfactory definition of competency is still complicated [28] and proposing a solid competency model applicable in different situations is still difficult [30]. A competency model generally speaking describes the competencies requested to successfully perform in a specific job, organization and industry sector [34]. Competency models are usually tailored according to the organizational characteristics and needs and the way the specific competencies are described and developed depends on the specific organizational culture, market, type of organization and strategic objectives [9]. Therefore, competency models are more oriented to identify competencies that enable a long term fit with the organization rather than short terms objectives [10]. As above mentioned it is difficult to define a structured procedure for the competency models' implementation [30], however, the main common steps are: gathering data about the organization, the strategic business objectives, the specific job characteristics and performance indicators, analyzing the extant literature and developing measurements focusing on behaviors rather than only on technical skills [19], collecting data and validating the tool through focus groups or surveys [6].

3 Review Methodology

In order to have a complete picture of the competency models available in the literature, we conducted a systematic literature search in the field of competency management involving peer reviewed journal articles published in the period between 2010 and 2020. The key words used were competency and its plural form competencies together with the word tools or models and their possible variants in the abstract or among the key words. The research criteria include journal articles at the final stage, written in English in the field of Business Management and Accounting. This search lead us to the identification of 103 articles. The 103 articles were analyzed by the authors applying inclusion criteria, that means identifying if the article effectively presents or develops a competency tool or methodology in the identified field. After the pre-analysis 43 articles were selected and the authors proceeded with the full text analysis. The full text analysis was conducted following a systematic approach, classifying each article according to the purpose and the methodology used. This process led to the identification of 27 articles relevant to the scope of presenting competency tools with a satisfactory description and use. The articles were than analysed according to the characteristic of the methodology. In the following session we present and discuss the results in detail.

4 Results

Table 1 classifies and summarizes the results of the literature review listing the articles included and the steps of the implementation of the competency models. As visible in Table 1 most of the articles adopt a competency model based on the analysis of the extant literature and of the documentation, on which the authors develop the competency model. Following, in most of the studies a panel of experts is consulted to discuss and better tailor the methodology to the case company or sector. After this, the competency model is tested and validated through qualitative and quantitative methods. The output of the competency model implementation and validation is a list of competencies grouped according to different criteria. From the review we deduce that competency models' implementation is extremely strategic in hospitality sector, indeed in the literature there are many studies carried out in this area. Only one study covers entirely the topic of digital organization analyzing the competencies needed to work in a virtual team in different business sectors.

Table 1. Results of the Literature review

Author	Sector	Method
Suhairom et al. [38]	Hospitality	Document analysis - consultation of a panel of experts - Semi-structured interviews through BEI (behavioral event interview) - Thematic data analysis and content validation
Xiao et al. [42]	Real estate project management	Data collection through BEI (behavioral event interview) - Data analysis and test
Lou et al. [26]	Hospitality	Review of previous studies - Delphi method – Survey - Data analysis
Aishaa et al. [1]	SMEs	Literature review
Shum et al. [35]	Hospitality	Review of previous studies - Development of the model - Consultation of a panel of experts Validation of the model - Implementation of the model
Brown et al. [7]	Medium-scale power utility company	Literature review- Document analysis – Interviews - Competencies identification - Toolkit development
Fernández-Ronquillo et al. [11]	Microentrepreneurs	Document analysis - Development of the model - Validation through a panel of experts
Bharwani and Talib [5]	Hospitality	Literature review
Goldman and Scott [14]	Different industry sector	Analysis of the competency models in use - Semi-structured interviews - Data analysis and triangulation
Krumm et al. [21]	Virtual team in different sectors	Literature review- Implementation of the Great Eight competency model - Data collection trough questionnaires - Data analysis
Jaafar et al. [18]	Construction industry	Literature review - Development of the model on the basis of the literature - Content validity Data collection through questionnaires and semi structured interviews and Data analysis
Salleh et al. [33]	HRD	Implementation of the ASTD competency model (American Society for Training and Development) - Grouping competencies - Survey - Data analysis

(*continued*)

Table 1. (*continued*)

Author	Sector	Method
Arafeh [2]	Entrepreneurship	Literature review - Development and implementation of a soft computing - Based entrepreneurial key competencies' model
Kwon et al. [22]	Workplace learning and performance competencies	Exploratory interviews - Literature review - Competency model development - Interviews - focus groups with experts to validate the model - Data analysis - Finalization of the model
Asili et al. [3]	Project-oriented organizations in oil and gas industry	Review of technical books to identify competencies - Competency model development - Consultation with a panel of experts and clients - Implementation of the model
Lambert et al. [23]	Services	Literature review - Definition of a list of competencies by four sets of experts - Test through a modified version of Delphi technique-Reliability and validity - Data analysis
Wang [41]	Hospitality	Literature review - Development of the model through Delphi method and survey - Reliability and validity - Data analysis
Busch [8]	Sales management	Literature review - Delphi method - Survey - Data analysis
Zhang et al. [43]	Construction Project Management	Tailoring and implementation of Emotional Competencies model – Survey - Data analysis
Koenigsfeld et al. [20]	Hospitality	Implementation of the Sandwith five domain competency model - Data collection Validation
Testa and Sipe [39]	Hospitality	Development of the model linking competencies to business goals - In depth interviews Inductive classification of results and creation of operative definitions
Madter et al. [27]	Project Management in construction ind.	Literature review - Development and implementation of a meta list competency model
Hatala and Hisey [15]	Career coaching professionals	Literature review - Focus group with experts - Implementation of the Career Coach Competency Model (CCCM) - Statistical validation of the final model

(*continued*)

Table 1. (*continued*)

Author	Sector	Method
Garman and Scribner [13]	Healthcare	Development of a draft model - Validation through survey - Follow-up analyses
Hu [16]	Hospitality	Deep interviews to explore the subject - Delphi method and ANP (Analytic Network Process)
Soderquist et al. [36]	HRM in Banking and Maritime	Identification of competency categories - Identification and coding of competencies In depth interviews - Data analysis and validation of the results
Lee et al. [24]	Consumer goods	Selection and development of the competency model - Validity and reliability measurement

5 Discussion and Conclusions

The results of the review show that research on competency models' implementation is fragmented and mostly characterized by a prescriptive approach where competencies are presented as job descriptions rather than as predictors of future needs [31, 37]. To our surprise, the results of the review suggests that the landscape of competency models is very obsolete and that contemporary requirements of digitization have not yet been incorporated into updated usable competency tools. Being competency models, frameworks implemented to identify the competencies needed to operate in a specific job or organization [34] their objective is to link human resource development and organizational strategies. In the actual organizations undertaking the digital transformation, competency models should be developed to be interactive and adaptable to the organizational change and strategy [31, 40]. According to this definition we identified and analyzed 27 competency tools presented in articles published between 2010 and 2020, that are useful and appropriate to be implemented in digital organizations. The 27 tools included in this review seems to be based on a very structured methodology, the majority of competency tools are based on a deep analysis of the extant literature on the basis of which the model is developed, another recurrent element is the discussion with a panel of experts. On this regard many studies adopt the Delphi method, that consists of collecting data from a panel of experts implementing an iterative process to make forecast and decisions about a specific topic. The methodologies implemented are both quantitative and qualitative, since the Delphi method supports both, as well as mixed methods. As emerged from this analysis, competency tools are flexible and adaptable at different business sectors and different scopes. The current review systematizes and improves the knowledge about competency models therefore it makes easier to research and practitioners the choice of the appropriate framework according to their scope. An additional contribution regards the theoretical and methodological discussion in the field of competency management. Indeed, the review shows the fragmentation of the field and

the lack of interconnection in the tool development. The available methodologies do not build on each other, despite the development process is explained in detail in most of the articles, only in few cases the theoretical background is clearly and explicitly described. Furthermore, a weakness of the discussion about competency tools is the lack of empirical evidence about their applicability and usefulness within the organizations facing the digital transformation. Indeed, providing evidence of their usefulness would encourage managers and practitioners to adopt the model, adding practical value to the academic research. The future contribution should be oriented at finding how competency models should look like to support organizations facing the digital transformation, pointing out competencies needed to work in an effective way in the digital organization.

References

1. Aishaa, A.N., Sudirmanb, I., Siswantoc, J., Andrianid, M.: A competency model for SMEs in the creative economy. Int. J. Bus. **24**, 4 (2019)
2. Arafeh, L.: An entrepreneurial key competencies' model. J. Innov. Entrepreneurship **5**(1), 1–26 (2016). https://doi.org/10.1186/s13731-016-0048-6
3. Asili, G.R., Hendi, S.S., Moallemi, S.A., Soofifard, R., Kamali, M.R., Shavvalpour, S., Vahabi, M.M.: Developing technical competency model to promote HRM in project-oriented organisations: a case for 3D petroleum system modelling in the Persian Gulf and Oman Sea. Int. J. Prod. Qual. Manag. **13**(1), 1–18 (2014)
4. Bassellier, G., Reich, B.H., Benbasat, I.: Information technology competence of business managers: a definition and research model. J. Manag. Inf. Syst. **17**(4), 159–182 (2001)
5. Bharwani, S., Talib, P.: Competencies of hotel general managers: a conceptual framework. Int. J. Contemp. Hosp. Manag. **29**(1), 393–418 (2017). https://doi.org/10.1108/IJCHM-09-2015-0448
6. Boyatzis, R.E.: Competencies as a behavioral approach to emotional intelligence. J. Manag. Dev. **28**(9), 749–770 (2009). https://doi.org/10.1108/02621710910987647
7. Brown, L., George, B., Mehaffey-Kultgen, C.: The development of a competency model and its implementation in a power utility cooperative: an action research study. Ind. Commer. Train. **50**(3), 123–135 (2018)
8. Busch, T.K.: Determining competencies for frontline sales managers in for-profit organizations. Adv. Dev. Hum. Resour. **15**(3), 296–313 (2013)
9. Campion, M.A., Fink, A.A., Ruggeberg, B.J., Carr, L., Phillips, G.M., Odman, R.B.: Doing competencies well: best practices in competency modeling. Pers Psychol. **64**(1), 225–262 (2011)
10. Clardy, A.: The strategic role of human resource development in managing core competencies. Hum. Resour. Dev. Int. **11**(2), 183–197 (2008)
11. Fernández-Ronquillo, M.A., Llinàs Audet, F.J., Sabaté i Garriga, F.: Competency model for microentrepreneurs in depressed environments. Int. J. Manag. Enterp. Dev. **17**(4), 363–387 (2018)
12. Ferrari, A.: Digital competence in practice: an analysis of frameworks (2012)
13. Garman, A., Scribner, L.: Leading for quality in healthcare: development and validation of a competency model. J. Healthcare Manag. **56**(6), 373–384 (2011)
14. Goldman, E., Scott, A.R.: Competency models for assessing strategic thinking. J. Strategy Manag. **9**(3), 258–280 (2016). https://doi.org/10.1108/JSMA-07-2015-0059.
15. Hatala, J.P., Hisey, L.: Toward the development and validation of a career coach competency model. Perform. Improv. Q. **24**(3), 101–122 (2011)

16. Hu, M.L.M.: Developing a core competency model of innovative culinary development. Int. J. Hosp. Manag. **29**(4), 582–590 (2010)
17. Ilomäki, L., Kantosalo, A., Lakkala, M.: What is digital competence. Linked portal. Brussels: European Schoolnet (EUN), pp. 1–12 (2011)
18. Jaafar, M., Nuruddin, A.R., Othman, N.L., Jalali, A.: Competency model for female project managers in the construction industry: a case study in Malaysia. Int. J. Project Organ. Manag. **8**(2), 197–215 (2016)
19. Jordan, J., Cartwright, S.: Selecting expatriate managers: key traits and competencies. Leadersh. Organ. Dev. J. **19**(2), 89–96 (1998). https://doi.org/10.1108/01437739810208665
20. Koenigsfeld, J.P., Kim, S., Cha, J., Perdue, J., Cichy, R.F.: Developing a competency model for private club managers. Int. J. Hosp. Manag. **31**(3), 633–641 (2012)
21. Krumm, S., Kanthak, J., Hartmann, K., Hertel, G.: What does it take to be a virtual team player? The knowledge, skills, abilities, and other characteristics required in virtual teams. Hum. Perform. **29**(2), 123–142 (2016)
22. Kwon, S., Wadholm, R.R., Carmody, L.E.: Assessing competencies: an evaluation of ASTD's Certified Professional in Learning and Performance (CPLP) designation. Eval. Program Plan. **44**, 48–58 (2014)
23. Lambert, B., Plank, R.E., Reid, D.A., Fleming, D.: A competency model for entry level business-to-business services salespeople. Serv. Mark. Q. **35**(1), 84–103 (2014)
24. Lee, J.G., Park, Y., Yang, G.H.: Driving performance improvements by integrating competencies with human resource practices. Perform. Improv. Q. **23**(1), 71–90 (2010)
25. Lerch, C., Gotsch, M.: Digitalized product-service systems in manufacturing firms: a case study analysis. Res. Technol. Manag. **58**(5), 45–52 (2015)
26. Lou, N.M., So, A.S.I., Hsieh, Y.J.: Integrated resort employee competencies: a Macau perspective. Int. J. Contemp. Hosp. Manag. **31**(1), 247–267 (2019). https://doi.org/10.1108/IJCHM-07-2017-0431
27. Madter, N., Bower, D.A., Aritua, B.: Projects and personalities: a framework for individualising project management career development in the construction industry. Int. J. Project Manag. **30**(3), 273–281 (2012)
28. Morgeson, F.P., Delaney-Klinger, K., Mayfield, M.S., Ferrara, P., Campion, M.A.: Self-presentation processes in job analysis: a field experiment investigating inflation in abilities, tasks, and competencies. J. Appl. Psychol. **89**(4), 674 (2004)
29. Oecd, E.: Oslo manual: Guidelines for collecting and interpreting innovation data. Paris 2005, Sp, 46 (2005)
30. Pearlman, K., Barney, M.F.: Selection for a changing workplace. Manag. Sel. Changing Organ. Hum. Resour. Strat. 3–72 (2000)
31. Polo, F., Kantola, J.: Valorizing the human capital within organizations: a competency based approach. In: International Conference on Applied Human Factors and Ergonomics, pp. 55–63. Springer, Cham (2018)
32. Rodriguez, D., Patel, R., Bright, A., Gregory, D., Gowing, M.K.: Developing competency models to promote integrated human resource practices. Hum. Resour. Manag. **41**(3), 309–324 (2002)
33. Salleh, K.M., Subhi, N.I., Sulaiman, N.L., Latif, A.A.: Generic skills of technical undergraduates and industrial employers' perceptions in Malaysia. Int. J. Appl. Bus. Econ. Res. **14**(14), 907–919 (2016)
34. Shippmann, J.S., Ash, R.A., Batjtsta, M., Carr, L., Eyde, L.D., Hesketh, B., Kehoe, J., Pearlman, K., Prien, E.P., Sanchez, J.I.: The practice of compentency modeling. Pers. Psychol. **53**(4), 703–740 (2000)
35. Shum, C., Gatling, A., Shoemaker, S.: A model of hospitality leadership competency for frontline and director-level managers: Which competencies matter more? J. Hosp. Manag. **74**, 57–66 (2018)

36. Eric Soderquist, K., Papalexandris, A., Ioannou, G., Prastacos, G.: From task-based to competency-based: a typology and process supporting a critical HRM transition. Pers. Rev. **39**(3), 325–346 (2010). https://doi.org/10.1108/00483481011030520
37. Sparrow, P.R.: Organizational competencies: creating a strategic behavioural framework for selection and assessment. Int. Handb. Sel. Assess. 343–368 (1997)
38. Suhairom, N., Musta'amal, A.H., Amin, N.F.M., Kamin, Y., Wahid, N.H.A.: Quality culinary workforce competencies for sustainable career development among culinary professionals. Int. J. Hosp. Manag. **81**, 205–220 (2019)
39. Testa, M.R., Sipe, L.: Service-leadership competencies for hospitality and tourism management. Int. J. Hosp. Manag. **31**(3), 648–658 (2012)
40. Vakola, M., Eric Soderquist, K., Prastacos, G.P.: Competency management in support of organizational change. Int. J. Manpower **28**(3/4), 260–275 (2007)
41. Wang, Y.-F.: Constructing career competency model of hospitality industry employees for career success. Int. J. Contemp. Hosp. Manag. **25**(7), 994–1016 (2013). https://doi.org/10.1108/IJCHM-07-2012-0106
42. Xiao, Y., Liu, J., Pang, Y.: Development of a competency model for real-estate project managers: case study of China. Int. J. Constr. Manag. **19**(4), 317–328 (2019)
43. Zhang, F., Zuo, J., Zillante, G.: Identification and evaluation of the key social competencies for Chinese construction project managers. Int. J. Project Manag. **31**(5), 748–759 (2013)

Dynamics of Personal Social Capital and Its Influence on Employee Growth in Organizations: A Cross Sectorial Analysis

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Abstract. This study explored how personal social capital influences employee growth in different industrial sectors in Ghana. This is informed by the prevailing argument on the need for knowledge generation on the role of social capital on employee growth, and which dynamics continue to gain currency in human resource management research. Using data from the banking, telecommunication and media sectors, it was found that the social interdependence between workers and other colleagues, information from their personal social networks, their personal relationships with colleagues that encourage the prevalence of trustful work environments, and the personal relationships they develop with others during social gatherings are all predictive of workers' personal social capital that contribute variously in enhancing their professional growth in the work environments of different industrial sectors. It is concluded that the incorporation of workers' personal social capital in organizations' human resource management systems will help add value to their productiveness.

Keywords: Social capital · Personal social capital · Employee growth · Banking sector · Telecommunication sector · Media sector

1 Introduction

The importance of generating knowledge on the role of social capital on employee growth is underlined by the notion that any organization that enjoys greater capitals is more powerful and has more support, a situation that is making managers try to increase their organization's capitals in bids to create value towards gaining more advantages in their competitive industrial environments. This organizational mindset is informed by the observations in the extant literature that the only capital of life is characterized by three entities, namely, physical capital, monetary capital, and financial capital. But contemporarily, new capitals, which included human capital, natural capital and social capital have been added, with each having important effect on the professional development and growth of human resource in organizations. Thus, with personal social capital referring to the individual's profit from his/her positioning in social network, which

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can be inside the organization or elsewhere [1], it is important to understand how such personal social capital informs the set of resources that individuals working in different industrial environments bring to the performance of their tasks through their own personal relations and the impact it has on their growth at their workplaces. Thus, there is the need to find answers to the questions as to whether there are commonalities in (i) the set of resources that employees working in different industrial environments bring to the performance of their tasks through their own personal relations, and (ii) the influence such personal social capital have on their growths in the organization. Therefore, the purpose the study is to provide an understanding on how personal social capital influences employee growth in different industrial work environments in Ghana. This is to address the gap on the prevailing argument among several researchers on the need for knowledge generation on the role of social capital on employee growth, and which dynamics has attracted much attention in the past two decades and continue to gain currency in human resource management research.

2 Literature Review

Social capital as defined by [1] and [2], is a set of resources such as, trust, norms, and linked networks that facilitate cooperation for mutual benefits and its result is different types of collective actions. These resources, according to [3], are accessed by the individual through social networks formed with other individuals. The social network is a social structure constituted by a set of social actors, which can be individuals or organizations, and a set of ties between them [4]. Personal social capital refers to the individual's profit from the individual's positioning in social network, which can be inside an organization or elsewhere [5]. Personal social capital, according to [6], deals with the set of resources that individuals bring to the performance of their tasks through their own personal relations. Among such resources, as outlined by [1, 2] and [6], are the number of social relationships the individual maintains, the amount of social events to which the individual is invited, the degree to which the individual attends these events, and the individual's involvement in various activities in the organization. As indicated by [6], the set of resources that the individual brings to the performance of their tasks through their own personal relations forms the personal social capital. Personal social capital has also been found by [7] to relate with different interactional dimensions at the individual level, including trust, social norms, shared visions, strong employee communication obligations and recognitions which are all linked to employee growth and well-being. An important effect of personal social capital on employee growth is the development of both bonding and bridging ties with others. According to [8] and [2], the bonding-ties connect the individual and others in the same social group. Regarding the bridging-ties, [8] and [2] see it as connecting the individual with diverse social groups, thus enabling the individual gain beneficial access to different resources own by individuals in the diverse social groups. Therefore, the bridging-ties aspect of personal social capital has a positive effect on employee commitment and performance as well as employee growth [2, 8]. Personal social capital also leads to other types of ties that affect the individuals' performance and growth. In this respect, expressive-ties developed from personal social capital was found to result in the individual acquiring a higher-level self-management

skill which contribute to his/her development [9], as well as providing him/her a higher level of well-being and commitment. Instrumental-ties developed from personal social capital has been found by [10] as promoting higher level of performance among employees. According to [11], the quality of the individual's instrumental-ties has an influential effect on the level of the individual's growth and performance.

3 Methodology

The study is guided by the quantitative method of perceptual evaluation [12]. In this method, units of measurement and measurement procedures that permit the comparison of different elements of activity are required [13, 14]. This implies that while work situations can be evaluated both experimentally and theoretically [13], expert judgments, such as the use of a five-point scale can also be used for the subjective evaluation of employees' perception of their work situations [14]. In this study therefore, the quantified philosophical approach was used to participants' subjective evaluations of their personal social capitals.

Data was collected from a sample of one hundred and twenty-two (122) employees in each of the three (3) industrial sectors, using a uniformly designed self-administering questionnaire. The snowballing sampling technique [15, 16] was used to select the 122 study participants from each sector. In using the snowball sampling procedure, the researcher got staff volunteers from other firms in each industrial sector who helped identified other participants. The questionnaire included a synopsis that explained the research purpose. A stepwise analytical approach was used. Firstly, a perceptual descriptive comparative analysis was conducted to establish the prevalence of social capital factors in the respective industrial sectors. This was followed by the conduct of factor analysis to determine whether prevailing factors identified from the first analysis are predictive of workers' personal social capital. The benchmark used for determining such predictiveness is [17]'s recommendation that the estimated factor loading must be 0.70 or higher. The analytic tool used is the SPSS, version 22.

4 Results and Analysis

4.1 Perceptual Comparison of Sectoral Prevalence of Personal Social Capital

All the 122 questionnaires administered in each of the three sectors were retrieved and found to be complete and usable. An analysis of respondents' perceptions of the prevalence of personal social capital in the three sectors (i.e. telecommunications, banking and media) was conducted using the following determining factors; (i) my professional life and growth at work is facilitated by the social interdependence between myself and colleagues, (ii) my company's rules encourage employees to develop personal social relationships as a way of enhancing teamwork, (iii) important information provided by my social and work contacts help enhance my professional life, (iv) my personal relations with colleagues encourage a trustful work environment which enhance my professional growth, and (v) my personal relationship with others during social gatherings helps enhance my professional growth at work. The analytic output for the sectors is shown in Table 1 here.

Table 1. Distribution of sectoral perceptions of the prevalence of personal social capital

PSC Factors	% Respondents*								
	telecom sector			media sector			banking sector		
	low	unsure	high	low	unsure	high	low	unsure	high
Social interdependence with colleagues.	9.02	7.38	83.61	5.74	16.39	77.87	9.02	6.56	84.43
Important information provided by personal social contacts.	11.47	15.57	72.95	9.84	13.93	76.23	13.11	21.31	65.57
Personal relations with colleagues in a trustful work environment.	9.84	6.56	83.61	8.20	14.75	77.05	4.10	12.30	83.61
Personal relations with others formed during social gatherings.	5.74	18.85	75.41	7.38	13.93	78.69	7.38	7.38	85.25

* Total number of respondents per sector = 122

As it is highlighted in Table 1 above, a majority of the study participants in all the three sectors (i.e. 83.61% in Telecom, 84.43% in Banking and 77.87% in Media) hold the perceptions that their professional lives and growth in their organizations are facilitated by the social interdependence that exist between them and other colleagues. This indicates that irrespective of the industrial sector, the social interdependence that exist between workers and other colleagues, contribute in facilitating their professional lives and growth in their organizations. Majority of respondents in all the three sectors (i.e. 72.95% in Telecom, 65.57% in Banking and 76.23% in Media) also hold the perceptions that important information provided by their personal social networks help enhance their professional life and work in their organizations. This indicates that irrespective of the industrial sector environment, important information provided by personal social networks, help enhance employees' professional lives and growth in their organizations. Similarly, majority of respondents in each of the three sectors (i.e. 83.61% in Telecom, 83.61% in Banking and 77.05% in Media) hold the perceptions that their personal relationships with colleagues encourage the prevalence of trustful work environments which enhance their professional growth. This indicates that irrespective of the industrial sector environment, employees' personal relationships with colleagues encourage the prevalence of trustful work environments which enhance their professional growth in their organizations. Also, majority of respondents in each of the three sectors (i.e. 75.41% in Telecom, 85.25 in Banking and 78.69% in Media) hold the perceptions that their professional growth in their organizations are enhanced by the personal relationships they develop with others during social gatherings. This indicates that irrespective of the industrial sector environment, the personal relationships they develop with others during social gatherings contribute in enhancing their professional lives and growth in their organizations.

4.2 Factors Analysis of Personal Social Capital in the Three Sectors

In the perceptual comparative analysis highlighted in Sect. 4.1 above, it merged that the personal social capital factors assessed appeared to prevail in all the three industrial sectors by virtue of majority perceptions of the study participants. Thus, in order to whether these factors are predictive of personal social capital (PSC) of workers in each of the three sectors, factor analysis was conducted for each sector. The results obtained, in terms of the Kaiser-Meyer-Olkin (KMO) and Bartlett's test statistics are shown in Table 2 below. As it is shown in the table, the estimated Kaiser-Meyer-Olkin (KMO) value for PSC in the telecommunication sector is 0.64, while that in the banking sector is 0.71, and that in the media sector being 0.61. As recommended by [35], this indicates that the correlation patterns of the PSC indicators in all the three sectors are good. The estimated chi-square (χ^2) value from the Bartlett's test for the PSC variable in the telecommunication sector is: $\chi^2 = 107.64$ ($p = 0.000$), which is highly significant ($p < 0.001$), while for PSC variable in the banking sector is: $\chi^2 = 146.49$ ($p = 0.000$), which is also highly significant ($p < 0.001$). that for the PSC variable in the media sector is: $\chi^2 = 65.27$ ($p = 0.000$), which is also highly significant.

Table 2. KMO measure of sampling adequacy and Bartlett's test result for personal social capital

Indicator	KMO measure	Bartlett's test of sphericity		
		χ^2	df	Sig.
Telecommunications	0.64	107.64	10	0.00
Banking	0.71	146.49	10	0.00
Media	0.61	65.27	10	0.00

The results from both the KMO and the Bartlett's tests show that it is appropriate to factor analyze all the personal social capital indicators tested. Thus, factors analysis was performed to identify the factors perceive by the study participants as predictive to their personal social capital. The factor loadings/regression values (r) for the 5 tested factors are shown in Table 3 below.

Using [17]'s benchmark for factor predictiveness, it is observable from Table 3 above that, the regression estimates for the factor depicting the workers perceptions that their professional lives and growth in their organizations are facilitated by the social interdependence that exist between them and other colleagues is predictive of their personal social capital in all the three sectors. The strength of this factor appears to be almost the same for workers in the telecommunications sector ($r = 0.70$; $r^2 = 0.49$); banking sector ($r = 0.71$; $r^2 = 0.50$); and the media sector ($r = 0.74$; $r^2 = 0.55$). Similarly, the regression estimates for the factor depicting the workers perceptions that important information provided by their personal social networks help enhance their professional life and work in their organizations is also predictive of their personal social capital in all the three sectors. The strength of this factors appears to be much higher for workers in the banking sector ($r = 0.81$; $r^2 = 0.66$) and almost the same for

Table 3. Regression estimates for personal social capital factors in the three sectors

Factors	*r*-values		
	Telecom	Banking	Media
My professional life and growth at work is facilitated by the social interdependence with my colleagues	0.70	0.71	0.74
Important information provided by my social and work contacts help enhance my professional life	0.73	0.81	0.74
Personal relations with colleagues encourage a trustful work environment which help my professional growth	0.70	0.64	0.79
Personal relationship with others during social gatherings helps enhance my professional growth at work	0.53	0.77	0.66

workers in the telecommunications sector ($r = 0.73$; $r^2 = 0.53$) and the media sector ($r = 0.74$; $r^2 = 0.55$). On the other hand, the regression estimates for the perceptions that their personal relationships with colleagues encourage the prevalence of trustful work environments which enhance their professional growth in their organizations is predictive of their personal social capital in the telecommunications and media sectors, but not in the banking sector. The strength of this factors appears to be much higher for workers in the media sector ($r = 0.79$; $r^2 = 0.62$) than in the telecommunications sector ($r = 0.70$; $r^2 = 0.49$). Similarly, the regression estimates for the perceptions that workers professional growth in their organizations are enhanced by the personal relationships they develop with others during social gatherings is predictive of their personal social capital only in the banking sector ($r = 0.77$; $r^2 = 0.99$), but not in the telecommunications and media sectors.

The findings from the above analysis are that, firstly, the social interdependence that exist between workers and other colleagues, as well as important information provided by their personal social networks, are both predictive of workers personal social capital in the telecommunication, banking and media work environments that contribute in enhancing their' professional lives and growth. Secondly, workers' personal relationships with colleagues that encourage the prevalence of trustful work environments workers is predictive of their personal social capital in the telecommunication and media work environments which enhance their professional growth in their organizations. Thirdly, personal relationships developed by workers with others during social gatherings is predictive of their personal social capital only in the banking work environment which contribute in enhancing their professional lives and growth in their organizations.

5 Conclusion

This study has provided understanding on the dynamics of workers personal social capital in the telecommunication, banking and media industrial sectors in Ghana. Based on the findings, it is firstly concluded that; the social interdependence that exist between workers and other colleagues, as well as important information provided by their personal

social networks are important human resource indices derived from their personal social capital which when appreciated and adapted in the human resource management systems of organizations in the telecommunication, banking and media industrial sectors will help enhance their' professional lives and growth of their employees. It is also concluded that workers' personal relationships with colleagues that encourage the prevalence of trustful work environments workers should be adapted as a useful resource in the human resource management systems of organizations in the telecommunication and media industrial sectors to help enhance their professional lives growth of their employees. Lastly, the personal relationships developed by employees with others during social gatherings should be adapted as a useful resource in the human resource management systems of organizations in the banking industrial sector to help enhance their professional lives growth of their employees.

References

1. Adler, P.S., Kwon, S.-W.: Social capital: prospects for a new concept. Acad. Manag. Rev. **27**(1), 17–40 (2002)
2. Putnam, R.D.: Bowling Alone: The Collapse and Revival of American Community. Simon & Schuster, New York (2001)
3. Lin, C.: Modeling job effectiveness and its antecedents from a social capital perspective: a survey of virtual teams within business organizations. Comput. Hum. Behav. **27**, 915–923 (2010)
4. Wasserman, S., Katherine, F.: Social Network Analysis: Methods and Applications. Cambridge University Press, Cambridge (1995)
5. Mouw, T.: Estimating the causal effect of social capital: a review of recent research. Annu. Rev. Sociol. **32**, 79–102 (2006)
6. Lazega, E., Mounier, L., Jourda, M., et al.: Organizational vs personal social capital in scientists' performance: a multi-level network study of Elite French Cancer Researchers (1996–1998). Scientometrics **67**, 27–44 (2006)
7. Milana, E., Maldaon, I.: Social capital: a comprehensive overview at organizational context. Period. Polytech. Soc. Manag. Sci. **23**(2), 133–141 (2015)
8. Podolny, J.M., Baron, J.N.: Resources and relationships: social networks and mobility in the workplace. Am. Sociol. Rev. **62**(5), 673–693 (1997)
9. Roberson, Q.: Justice in self-managing teams: the role of social networks in the emergence of procedural justice climates. Acad. Manage. J. **55**(3), 685–701 (2012)
10. Adler, P., Kwon, S.W.: Social capital: prospects for a new concept. Acad. Manag. Rev. **27**, 17–4 (2002)
11. Zhu, B., Watts, S., Chen, H.: Visualizing social network concepts. Decis. Support Syst. **49**, 151–161 (2010)
12. Sanda, M.A., Johansson, J., Johansson, B., Abrahamsson, L.: Using systemic structural activity approach in identifying strategies enhancing human performance in mining production drilling activity. Theor. Issues Ergon. Sci. **15**(3), 262–282 (2014)
13. Bedny, G.Z., Karwowski, W.: A Systemic-Structural Theory of Activity: Applications to Human Performance and Work Design. Taylor and Francis, Boca Raton (2007)
14. Sanda, M.A.: Cognitive and emotional-motivational implications in the job design of digitized production drilling in deep mines. In: Hale, K.S., Stanney, K.M. (eds.) Advances in Neuroergonomics and Cognitive Engineering, Advances in Intelligent Systems and Computing 488, pp. 211–222. Springer, Switzerland (2016)

15. Sanda, M.A.: Impact of value-based transformational leadership in privatizing government institutions in a developing economy: a case study. Bus. Manag. Quart. Rev. **1**(3), 1–13 (2010)
16. Patton, M.Q.: Qualitative Research and Evaluation Methods: Integrating Theory and Practice, 4th edn. Sage Publications Inc, Newbury Park (2014)
17. Schumacker, R.E., Lomax, R.G.: A Beginner's Guide to Structural Equation Modeling. Lawrence Erlbaum, Mahwah (2004)

Competences in Expert Sales

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Abstract. The business models of traditional banks and financial institutions have in the past been very conservative, and the stability of the business environment has also maintained the stability of the competencies required of those in the industry. However, the emergence of alternative sources of finance and growing competition has created a situation where the competences of financial companies and practitioners are under pressure, one of which is competences in sales.

Keywords: Expert sales · Competences · Disruptive change · Glogalization

1 Introduction

The transformation of the business environment over the last ten years has been extremely rapid, and the pace of change is still accelerating, partly due to globalization and digitalization. New ways of business, like digital commerce platforms with cost-effective and easy access to large customer volumes, have accelerated the transformation. Almost exponential growth of digital commerce has created major digital commerce centers such as Amazon, Alibaba and E-bay. Trade-related changes and the emergence of major international digital trading venues have made it possible for smaller companies to globalize, which is seen in the growing spectrum of companies operating on different trading platforms. A good example of increased trading and sales opportunities for small and medium-sized businesses is the Amazon FBA. More and more SMEs are entering the international market. The importance of digitalization is a key factor when SMEs target international markets. The importance of the Internet as a viable marketplace and operating there requires different approaches to traditional business [1, 2]. The consequences of the transformation are not limited to sales as a business activity, but also to the relationship between marketing and sales. The boundary between marketing and sales has blurred making business interaction more customer experience, especially in the context of small businesses. Different browser solutions or customer-related keywords in the digital commerce have substituted the beginning of traditional sales process, changing the sales process as a whole. Digitalization has enabled the customer to gather information and compare capabilities already in the process of defining their own needs, which in many cases means that the customer selects the contact method, time, and communication medium that the traditional sales funnel has more control over the sales organization and vendor.

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The term digital disruption has been used to describe a situation, where new opportunities for digitalization, along with new business models, bring about a change in the value promise of existing products or services [3]. By definition, Amazon FBA can even be considered as a model example of digitalization, which is itself and directly and indirectly generates new business models. At the same time, digitalization and globalization have also created a trend whereby large platforms are beginning to break down and to localize for a variety of reasons, like regional or global political goals, legislation, trade areas or culture-related trading practices. Markets, commerce and sales are no longer solely globalized, but simultaneous localization can be observed, forming the term Glogalization, which describes the event [4].

2 Financial Market Disruption

The functioning of the financial markets is closely linked to the business activities since one of the roles banks and financial institutions is to provide access to the capital needed by companies and individuals. Therefore, financial markets to be are under the same influencing forces, like rapid digitalization and Glogalization.

It was found in the Bank of Finland's current Euro & Talous analysis, that companies are increasingly seeking financing outside the banking sector, while the transformation of the business environment in financial markets is ongoing [5]. The financial market upheaval is strongly linked to the consequences of digital disruption for businesses and individuals described above, resulting in the direct and indirect spread of digital disruption to finance as a function and industry. The emergence of electronic platforms has enabled various new activities such as the financing of companies, projects or projects through international crowdfunding. One example of a new possibility is the financing of Homeworld 3, which has been and will be supported by the Fig.co platform [6].

The actual size of the non-bank financial market is estimated to be about $ 100 trillion, 55% of the funding in the euro area, and it is expected to grow further due to low interest rates and tighter regulation [7]. There are clear indications of a shift in the demand for corporate financing from non-banks to more and more banks. Four key factors in choosing non-bank instead of traditional are found to be a) demand for low-interest financing is greater than supply, b) ease to have financing, c) collateral requirements and d) strategy, which includes possibility to provide financing for risky endeavours [8]. The banking sector is undergoing many changes which banks must react to [9]. Banks are focused on large companies and high-growth start-ups, and SMEs that are critical to the economy may be left without funding or seek funding elsewhere. As a result of stricter bank regulation and strong market entry, non-banks and financial platforms have already begun to form cooperative structures in which the total financing required by the company is organized through various combinations, with banks, financial platforms, shadow banks and other funding providers acting individually according to their own risk bearing capacity. The financing received by the company may thus consist of different parts and combinations, which will require more expertise from both the loan applicant and the credit solution provider. Partly due to this, traditional banks run the risk of losing their position as SME finance providers if they do not realize they are expert sellers and thus seek and sell their own services to support SME finance. Part of the obstacle to SME investment is access to finance [10].

3 Research Conducted

Based on the above-described market and financial developments, an interview study was conducted for 31 banks operating in Finland to determine the bank's perception of the impact of disruption on the banking business in terms of sales function and customer value development. The study was limited to banking institutions and their corporate financing and their size varied from small, local banks to international banks, operating in Northern part of the Europe. The results of the interviews suggest that banks continue to focus very much on their traditional sales and business models, which have introduced elements of e-business such as the transition of customer service to web-based self-service and the expansion of bots.

The results of the interviews also show that the attitude of different banks towards sales is not uniform. Smaller banks used the term "expert salesperson" in their responses while larger continue to strive to promote financial product sales as customer service. Smaller banks also expressed the view that alternative sources of finance have not yet gained or are gaining significant foothold in the financial markets. It was seen from the responses the banks' new customer acquisition means traditional networking and contacting means in which banks participate in events and meetings hosted by a third party, online marketing via social media is also well established. None of the interviews highlighted clearly value created by the customer or the value produced with the customer.

A clear difference in the responses is also reflected in their attitude towards financial product automation. In can be seen from the responses that the focus on smaller banks in automation and the use of AI appears to be instrumental and auxiliary in nature, whereas the focus on digitalization of larger and more internationally oriented financial institutions the mechanization of the function.

The impact of Glogalization in banking can be inferred mainly from the cost and speed targets associated with the digitalization lending process, not as a result of changes in the market or business concepts of the company or consumer. The responses of interviewees to the concept of Glogalization, in which familiarity with local legislation is seen as a significant part of the benefit of a bank operating in a regionally limited environment. Responses thus see local legislation as an obstacle to the activities of international financial firms and at the same time as a safeguard for local operators.

During the study, the concept of an expert salesperson was introduced instead of defining a previously used customer service or traditional salesperson. The purpose of the concept introduction was to highlight the change in banking and banking market conditions described above. The concept was also based on the results of earlier consumer financial services interviews, in which the commercialization of customer service has become very clear. Based on the responses, the banks 'views on the digitalization of banking services and the automation of services seem to be parallel with the size of the bank, but otherwise, banks' views differ by size significantly from the goals of digitalization, which will also affect the skills requirements of individuals selling financial products.

4 Expert Sales

From a sales perspective, when looking at the answers in study together with the change, the response from the banks conveys a pattern of thinking about the structure of the traditional funnel sales process [11]. This also seems to be reflected in the implementation of electronic services. In connection with a loan offer, the granting of a loan is based on the data generated by the system. From the banks' point of view, the competitive advantage is seen as the ease of applying for a loan, the speed of the process, and the cost savings of early loan granting. The model can be seen as an expression of a mechanical loan process, where the customer commits himself to the lowest-priced entity rather than the bank itself.

As sales tasks and products become more complex, the sales funnel has also begun to evolve towards expert sales. Traditional sales funnel shows sales as a unique event, but in expert sales it is imperative to modify the sales process towards the next potential sale. The change is partly the result of a shift in customer-centered thinking and product service, which means, for example, the transformation of a single physical product into an integral set of products and services (Fig. 1).

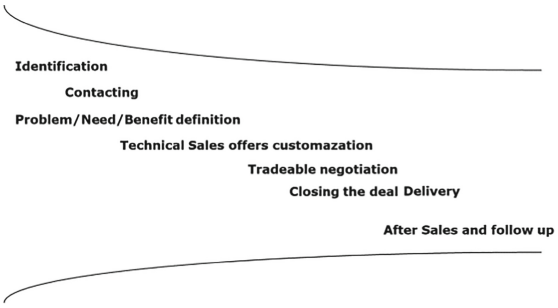

Fig. 1. Expert sales process

Expert sales seek to move an individual transaction further toward ongoing collaboration, while at the same time securing, for example, entry into the next bidding or additional sales related to the initial trade. Based on interviews, this approach would appear to be directed by smaller banks in an effort to refine the customer towards a total customer base while at the same time increasing the value of the customer by providing features that he or she believes are worthwhile and ready to pay. The sales funnel structure and process steps continue to change as customer relationships become longer and deeper, narrowing the funnel's nexus acquisition ratio relative to the other end of the funnel (Fig. 2).

In value sales, the value gained by the customer shifts to the value of the whole and to co-operation instead of a single sale. Collaboration or trade that takes place as needed and where possible, whereby the sales process repeats itself (awareness, exploration, evaluation, conversion purchase and commitment) to form the Demig Continuous Improvement Model (PDCA) cycle that describes the experience to ever-deepening customer relationship [12].

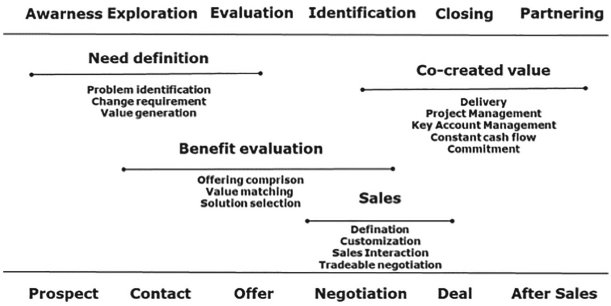

Fig. 2. Value sales process

The customer experience to deepening customer relationship means diminishing the importance of an individual product or trade, and at the same time increasing customer experience in business-to-business trading, which can take the form of varying degrees of cooperation or joint creation of networks or other forms of cooperation. Through its customer experience, the customer becomes the creator of their own customer experience [13].

From the company's point of view, partially replacing expensive new customer acquisition with improved customer loyalty and incorporating customer experience into the sales process is particularly suited to business where long-term customer relationship is an objective or a consequence, for example, of product features. The cost of acquiring a new customer and the loss of revenue from losing an old customer are significant to the bank's operations [14].

5 Competences in Expert Sales

Employee competencies and job related with competencies have been studied by different authors from different perspectives and with different approaches, which really indicates the speed of change and the need to produce change related information. To determine the competencies expert sales, you need to evaluate the relationship and differences between customer service competencies and competencies in the retail or, more correctly, industry, and to take into account industry characteristics and change, using the sales process steps described earlier in the value sales process.

In order to avoid functional differences in the definition of competences, an earlier study was used to assess the competences required, with descriptions of both the expert service and B to B sales competences [15]. Combining the competence outcomes of the previous study and our results were mirrored in industry change and the theme interview conducted. After comparing and merging, the following results of the competences required in Expert Sales emerged (Fig. 3).

The above is a description of expert sales competences, combining previously required skills requirements in various fields with the concept of expert sales and taking into account the digital disruption in the finance industry and the changing business environment experienced by bank customers.

	Person's skills	Person features
Competences with active development	Learning competences Precise education in the field, often college Language skills Sales skills include the ability to close a trade Product related expertise problem-solving ability	Social competences Listening to the customer Understanding customer needs Ability to listen to the customer Conversation Skills Information sharing Readiness to express opinions
Competence developed passively or semi passively	Components of Knowledge Development Product knowledge, readiness and maintenance Understanding Entities Desire and need for education Independent initiative Ability to take responsibility	Personal Competencies Self-starter Responsibility Ability digit Knowledge sharig Perseverance Patience Flexibility

Fig. 3. Competences in expert sales, adapted from [15]

6 Conclusions

As a result of several simultaneous influences of change, companies and industries need to conduct fast and responsive business. Part of the change force for banks is to a certain part of the financial sector, banks. The objectives of banking regulation are clear, but as a result of simultaneous changes, global and, to some extent, traditional non-monetary activities such as cryptocurrencies are emerging, the regulation of which or their impact will be challenging for states. Changes in the operating environment, technology and operations of companies require all those working in the company to be prepared to meet the new skills requirements resulting from the continuous change.

Undertaking financial services and product sales requires understanding and responding to large-scale rapid market changes, product knowledge, ability to communicate and tailor with the customer, applying personalized value to the customer, creating value with the customer and delivering the customer journey.

References

1. Ahtonen, Ahola, Hansson, Hassinen, Hämäläinen, Kostiainen, Kyläkoski, Paatero-Kaarnakari, Pirinen, Reijonen, Reponen & Somermaa: pp. 46–47 (2009)
2. Dominguez, N., Mayrhofer, U.: Key Success Factors of SME Internationalisation: A Cross-Country Perspective. Emerald Publishing (2018)
3. Yu, D., Hang, C.: A reflective review of disruptive innovation theory. Int. J. Manage. Rev. **12**(4)
4. Storper, M.: The limits to globalization: technology districts and international trade. J. Econ. Geogr. **68**, 60–93 (2016)
5. Hirvionen, A., Walta, V.: Bank of Finland Bulletin. Bank Of Finland. https://www.eurojatalous.fi/fi/2019/artikkelit/luotonanto-pankkisektorin-ulkopuolelta-kasvussa/
6. https://www.fig.co/campaigns/homeworld3
7. Guindos, L.: Europe's role in the global financial system. In: Nederlandsche Bank Conference: Forging a New Future Between the UK and the EU. https://www.ecb.europa.eu/press/key/date/2020/html/ecb.sp200108~323f3e7dac.en.html
8. Riasi, A.: Competitive advantages of shadow banking industry: an analysis using porter diamond model. Bus. Manag. Strategy **6**(2), 15–27 (2015). ISSN 2157-6068 2015

9. Fungáčová, Z., Toivanen, M., Tölö, E: Bank of Finland Bulletin. Bank Of Finland https://helda.helsinki.fi/bof/bitstream/handle/123456789/13928/eurotalous_analyysi_3.pdf
10. Yritysrahoituskysely Suomen Pankin selvitykset ja raportit. Suomen pankki (2015). https://helda.helsinki.fi/bof/bitstream/handle/123456789/13947/Yritysrahoituskysely_2015.pdf?sequence=1/s.25
11. Kotler, P., Armstrong, G.: Principles of Marketing, 10th edn. Pearson/Prentice Hall, London/Upper Saddle River (2004)
12. Johnson, C.N.: The benefits fo PDCA. Qual. Prog. Am. Soc. Qual. (2002). https://search.proquest.com/docview/214762325/fulltextPDF/F951442F3A08409APQ/1?accountid=14446
13. Prahalad, C.K., Ramaswamy, V.: The Future of Competition: Co-Creating Unique Value With Customers
14. Wisskirchen, C., Vater, D., Wright, T., De Backer, P., Detrick, C.: The customer-led bank: converting customers from defectors into fans. Strategy Leadersh. **34**(2) (2006)
15. Vehmas, T.: Pk-yritykset ja työvoiman kohtaanto: Mitä pk-yritykselle tarkoittaa sopiva työvoima? Työ- ja elinkeinoministeriön julkaisuja. Työ ja yrittäjyys 47 (2014)

Emotional Labour and Turnover Intention Among Teachers: The Moderating Role of Team Support

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Abstract. The art and science of teaching has been profoundly described as full of emotional activity but interestingly, not much is known of the emotional demands of the profession and more especially the effects of these on the individual's wellbeing. This research investigates the relationship between emotional labour, emotional exhaustion and turnover intention among Ghanaian teachers. Further, the study examines whether team support plays a moderating role in the relationship between emotional labour and emotional exhaustion with focus on addressing the retention of teachers in the profession. A cross-sectional quantitative data was obtained using self-completed questionnaires. A total of 628 teaching staff were surveyed in the second cycle schools in the Accra Metropolis. Structural equation modeling was used to test the study's hypotheses. Results of the study revealed a significant association between emotional labour and turnover intention. The study also found a positive relationship between emotional labour and emotional exhaustion. In addition, the model shows that 'faking' has a significant negative effect on retention whereas 'hiding' predicts emotional exhaustion, leading to an increase in turnover intention. More experienced teachers reported higher levels of emotional labour. Team support has been found to moderate the relationship between hiding and emotional exhaustion, which could have subsequent influence on employee turnover intention. The presence of a strong team support system at the workplace could be useful for managing the emotional demands of teachers' job role, with implications for their well-being and retention. There is the need for teachers to be aware of emotional demands of their profession in order to promote the acquisition of such skills by both experienced and newly trained teachers.

Keywords: Emotional labour · Emotional exhaustion · Hiding · Faking · Teachers · Team support

1 Introduction

Research has indicated over the years that, teachers are more predisposed to work-related stress, including psychological distress and burnout compared to other professionals as

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it involves interacting with people from diverse socio-cultural and religious background [1–3]. Considering the nature of the teaching job, teachers, just like other service workers are often exposed to emotionally demanding work environment as they interact with learners on daily basis. As a result, they are required to regulate their feelings and expressions in order to be effective [4, 5]. Also, teachers in developing countries including sub-Saharan Africa are likely to experience emotional labour due to increase in workload, poor teaching and learning facilities and low work involvement, especially, at the basic level; this could contribute to teachers' turnover. Previous studies provide evidence suggesting that teachers all over the world experience varied stressful situations, including job-specific hazards, such as preparation of teaching notes, large class sizes, low learner motivation and misbehavior [6–10]. They were also found to experience more general stressors such as meeting deadlines, administrative demands, lack of human and technical resources and perceived pay inequity [11–18].

The teaching profession is highly associated with emotional activity [19]. As such, for a teacher to become effective, the individual must learn to effectively manage his/her own emotions and the emotions of other people. For example, teachers are expected to safeguard the emotional well-being of their learners as well as their own physical safety [20, 21]. They should be considerate and treat learners with kind-heartedness as they strive to suppress any feelings of intolerance or anger [22]. Previous scholars have noted that teachers are required to continuously manage their emotions in ways that are similar to service providers [23], as the duties of a teacher involve a considerable amount of emotional labour. Emotional labour refers to the effort, planning and control an individual needs to express organizationally desired emotion during interpersonal transactions [24]. [25] studied German teachers and observed that emotional labour relates positively to emotional exhaustion. While research has shown that emotional labour of teachers has positive effect on work outcomes, there are few empirical studies examining the influence of emotional labour on retention of teachers. In order to extend existing knowledge of research into teacher stress for the development of effective interventions to enhance staff retention, the present study investigates the relationship between emotional labour and turnover intention among teachers. The study further seeks to examine whether team support moderates such a relationship.

2 Theoretical Background: Conservation of Resources (COR)

The conservation of resources theory as proposed by [26] states that individuals consciously make efforts to maintain and protect a wide range of resources to enhance their coping capacity and minimize the potential loss of resources. This theory presumes stress is likely to emerge from three main circumstances. Thus, when there is a perceived depletion of resources, actual loss of resources and when resources have not been adequately replenished after it has been invested [26].

Therefore, it has been recognised that demanding jobs are likely to result in frequent expenditure of resources at a rapid pace, which could increase an individual's vulnerability to burnout [27]. In this study, we contend that teachers' perceptions of a strong team support could be a valuable resource that allows depleted resources to be replaced in order to reduce the risk of burnout. As teachers are predisposed to burnout, it would

be helpful to examine effective intervention strategies that could help reduce burnout and promote teacher retention. Accordingly, the current study examines the moderating role of team support in the relationship between emotional labour and burnout with implication for turnover intention (Fig. 1).

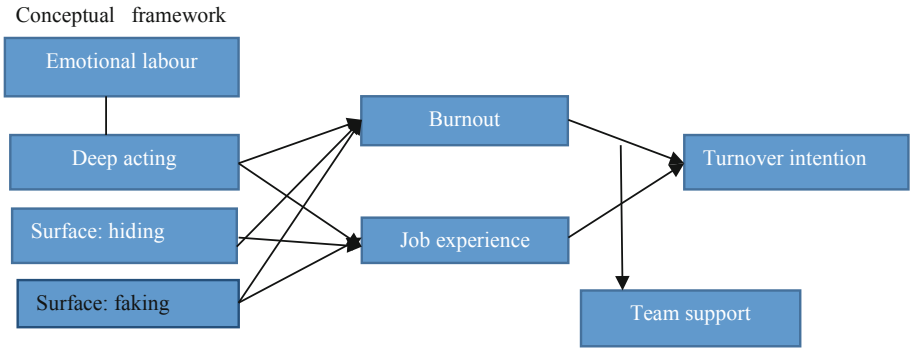

Fig. 1. Conceptual framework

2.1 Conceptualizing Emotional Labour

Employees are engaged in emotional labour so as to fulfill organizationally desired behaviour associated with their job [28]. Emotional labour is largely displayed through surface acting and deep acting [29]. While surface acting relates to the ability of people to modify and control their emotions superficially without altering their internal feeling [30], deep acting involves people's effort to influence their inner feelings to induce desired emotional expression when interacting with others [31, 32]. Moreover, surface acting was also found to consist of two main components - hiding and faking [33]. Hiding involves concealment of genuine emotions that is contrary to the expectations of the organization. Faking on the other hand, reflects the expression of emotions that are consistent with what the organization expects. As the teaching profession is associated with emotional activities [34–36], teachers are required to show empathy and demonstrate that they are concerned and care about their learners [37–40].

2.2 Emotional Labour and Burnout

Burnout is a response to stress which stems particularly from stressful work situations [41, 42] as evident in the teaching profession [43, 44]. A number of factors accounting for this include work overload [45, 46], low work involvement [47], demanding learners [48], poor working environment [46, 48] and lack of social support [48, 49]. Empirical evidence indicates that emotional labour is significantly related to emotional exhaustion, a key component of burnout [50, 51]. Eventually, this may have an influence on the intention of teachers to leave the profession. Previous research report that emotional labour has significant positive effect on burnout through a state known as emotional

dissonance [52]. Emotional dissonance describes the discrepancy between displayed emotion and internal feeling experienced by individuals [53]. Research results show that displayed emotions not felt by the individual can produce emotional exhaustion [54].

Results arising from previous research revealed that hotel workers who utilized surface acting are more likely to suffer from exhaustion than those workers who are engaged in deep acting [14]. Thus, emotional labour through surface acting and deep acting can have several effects on burnout [55]. Therefore, it is reasonable to propose that both hiding and faking are likely to increase burnout, while deep acting is likely to have a negative effect on burnout.

H1a: Hiding and faking will be positively related to burnout
H1b: Deep acting will be negatively related to burnout

2.3 Emotional Labour and Job Experience

It has been acknowledged that the longer employees are engaged in emotional labour, the more negative the consequences for stress as a result of steady reduction of emotional resources [56, 57]. It has also been argued, however, that the availability of social support and the use of appropriate coping strategies could assist employees in dealing effectively with emotional demands of their work [58]. Thus, we propose the following hypotheses:

H2a: Hiding has a positive relationship with job experience.
H2b: Faking has a negative relationship on job experience

2.4 The Moderating Role of Team Support

The role of team support in dealing with occupational stress cannot be underestimated. For example, research has found strong correlation between employees' perceptions of a supportive working team and job performance outcomes such as employee well-being, enhanced health status and job retention [59]. The direct effects and the moderator or buffer models have been widely used to explain the effect of social support in organisations [60]. While the direct effects model suggests that team support has a positive effect on well-being irrespective of the amount of stress an individual experienced, the moderator or buffer model presume that team support is a resource that is most valuable for people who are experiencing high levels of stress [61, 62]. In fact, there are plausible reasons asserting that team support could fully moderate the relationship between emotional labour and strain at the workplace. First, employees who experience more supportive interpersonal relationships at work may find it easy dealing with emotional demands associated with their job role. Second, employees who perceive supportive work environment, especially, from co-workers are likely to report lower levels of emotional labour. Third, the ability to disclose emotional events and 'true' feelings in a supportive work environment might be useful in developing more effective coping strategies that protect them against health risks and this could influence their intention to leave the profession [57]. Since much less is known about the influence of team support on emotional labour, the current study examines the moderating effect of team support in the relationship between emotional labour and turnover intention.

H3a: Team support will moderate positively the relationship between burnout and turnover intention.
H3b: Team work will moderate the relationship between job experience and turnover intention

3 Design

Using the Ghana Education Service Database 2018, the cross –sectional study questionnaires were distributed and completed by the respondents at pre-determined time agreed on by the researchers and the respondents. This was conducted using the quantitative design.

4 Participants

Though Eight hundred (800) teachers in the second cycle schools within the Greater Accra Metropolis were sampled for the study, the returned questionnaires completed by the sampled teachers in their various schools were six hundred and twenty-eight (628) with 70% being female teachers. The average ages and length of teaching were thirty-five (35) years and twelve (12) years respectively.

5 Measures

Emotional Labour Scale (ELS) by [63] was adapted and used for the study. This was necessary because of the need to measure the various sub-components of surface and deep acting and its further division into faking and hiding emotions. Measurement was done on a 5 point Likert scale where 1 is strongly disagree and 5 is strongly agree. The sub-scales had Cronbach's alphas of 0.76 on intense emotions, 0.75 and 0.86 for deep and faking emotions respectively. On how frequent emotions occur, the study had 0.68, hiding was 0.72 and 0.82 for variety of emotions.

Oldenburg Burnout Inventory (OLBI) was adapted from [45]. Both exhaustion and disengagement with Cronbach's alpha of 0.75 and 0.77 respectively were measured by items on a 5 point Likert scale from 1: never to 5: Always.

Team Climate Inventory (TCI) by [64] was used to measure the moderating effect of team support. Cronbach's alphas for Vision, Orientation, Safety, Innovation and interaction were 0.95, 0.88, 0.92, 0.91 and 0.89 respectively.

Turnover intention subscale with Cronbach's alpha of 0.90 and measured on a 5-point Likert scale from 1: 'Strongly disagree' to 5: 'Strongly agree' was authored by [65].

6 Data Analysis

Both standardized and unstandardized scores were generated with the help of the SPSS, but the data analysis was done using the standardized scores. Structural equation modelling (SEM) was used to test for all hypothesis stated, adopting the parameter estimates using the maximum likelihood function [66].

7 Validity and Reliability

The structure of model fit for the observed variables of emotional labour, burnout and team support measurement scales adapted, were confirmed for validity and reliability using the Confirmatory factor analysis (CFA). But for the few items in the outcome variable of turnover intention, the CFA could not be used. Hence comparison was made to the null hypothesis with the assumption that there was no relationship existing among the variable for the study [66].

8 Results

Findings show that the respondents mostly applied the hiding emotion in the performance of their duties, followed by deep acting and faking. Results also revealed that there was a much positive relationship between burnout and surface acting dimensions of hiding and faking. Hence the H1a hypothesis was supported. Nevertheless, the relationship between burnout and deep acting was significantly negative. Hence hypothesis 1b was not confirmed.

Further, on the job experience intervening effect, thus to test for the influence of job experience on burnout and turnover intention, the analysis revealed a much greater negative relationship between faking and job experience thereby supporting hypothesis 2b.

Given the outline on processes involved in determining the effect of moderations as in [67], the researchers tested this effect by first normalizing all scores of the observed variables before the addition of all individual scores of deep acting, hiding and faking. The added score was then multiplied with the total score of team support for the interaction effect. Findings indicate that the relationship between burnout and job experience was influenced by team support and ultimately on the intention of employees to quit. Hence, hypothesis 3 was fully supported (Tables 1 and 2).

9 Discussion

Based on the findings, the researchers are conclusive on the notion that surface acting of emotional labour does have a much greater positive influence on teachers' intention to quit the profession. Interestingly, this has been consistent with previous empirical research that have found that surface acting significantly predicts burnout than deep acting [68]. This is so because, much efforts and intention is needed and exerted in order to hide and fake emotions than that of deep acting which comes out naturally. So hiding and faking will put greater demands on teachers in second cycle schools to harness more resources for increased surface acting engagements [69, 70].

Again, as to whether burnout mediates the relationship between hiding and turnover intention, our study's findings validated that of [71] whose result agrees with the conservation of resources theory (COR) [26], that having access to more resources in replacement to what is utilized may not be available hence preventing people to allocate more resources for effective performance. The resultant effect is in burnout which ultimately gives way to turnover intentions to prevent or stop the cycle of losing more resources.

Table 1. Path diagram for emotional labour and turnover intentions showing regression weights and t-values

Hypothesis	Structural path	Path coefficient	t-value (Bootstrap)	Hypothesis results
H1a	Faking emotion → burnout	0.070	1.385	Not Supported
H1b	Hiding emotion → burnout	0.151**	3.336	Supported
H2a	Faking → job experience	0.210**	4.283	Supported
H4	Hiding → job experience	0.053	1.063	Not Supported
H5	Burnout and job experience → turnover intention	0.162**	3.962	Supported

Note: **t-values are significant at $p < 0.01$

In addition, this study has revealed that to mitigate the effect of surface acting emotion on observed variables of burnout and turnover intentions is to have in place a very effective team support. The need for building an effective team support cannot be underemphasized since burnout is very pervasive among teachers who are most likely to use hiding strategy to manage their emotions at work. Significantly, a critical means to replenishing used resources is to have an effective team support in place to reduce exposure to burnout effects [72].

10 Implications for Practice

For acquisition of skills in managing emotional labour, there is the need to inculcate the concept into training and development workshops for teachers, not forgetting the teaching syllabus of teacher trainees to enable then build capacity and create awareness of the self-regulation strategies needed to handle issues in relation to emotional labour in the teaching profession [73].

The study's findings have demonstrated the importance of team support in regulating effect of hiding emotions on burnout and teachers' turnover intention. Thus, it is paramount for HR professionals specifically and general managers of organizations to have a deliberate intention to build and use effective teams in their respective organizations to reduce such negative effects. Moreover, pervious research has revealed the benefits of peer teaching and coaching among teachers in providing symbiotic support to parties concerned. So managers and supervisors must consciously encourage teacher networks and cohesion opportunities thereby building knowledge and skills needed for managing emotions at work [74].

Table 2. Moderation Test Results for team support

Rival models	Direct effects: model 1	Direct effects: model 2	Moderated effects: model 4
Deep acting → Turnover intention	0.070	0.101**	0.102**
Faking → Turnover intention	0.151***	0.162***	0.144***
Hiding → Turnover intention	0.210***	0.189***	0.207***
Participant safety → Turnover intention	0.053	0.060	0.045
Burnout/job experience → Turnover intention	0.162***	0.149***	0.144***
Team support → Turnover intention		0.197***	0.200***
Teamsupp*faking → Turnover intention			−0.067
Teamsupp*deep acting → Turnover intention			−0.039
Teamsupp*hiding → Turnover intention			0.175*
R^2	0.180	0.217	0.237
ΔR^2		0.037	0.014

Note: ***t-values are significant at $p < 0.01$;**t-values are significant at $p < 0.05$; *t-values are significant at $p < 0.10$

11 Study Limitations

The inability to make causal inferences was one of the study's limitations because the cross sectional design approach makes it impractical to test for causality among the observed variables. For instance, though the study found a positive association between hiding and burnout, it is a challenge to specifically show the direction of causality in the relationship. The researchers suggest the use of the longitudinal study design to test for casual inferences.

References

1. Johnson, S., Cooper, C., Cartwright, S., Donald, I., Taylor, P., Millet, C.: The experience of work-related stress across occupations. J. Manag. Psychol. **5**(1), 2–5 (2005)

2. Jones, J.R., Huxtable, C.S., Hodgson, J.T., Price, M.J.: Self-reported Work-Related Illness in 2001/2002: Results from a Household Survey. HSE Publications, Sudbury (2003)
3. Kyriacou, C.: Stress-Busting for Teachers. Stanley Thornes, Cheltenham (2000)
4. Brunetto, Y., Teo, S.T., Shacklock, K., Farr-Wharton, R.: Emotional intelligence, job satisfaction, well-being and engagement: explaining organisational commitment and turnover intentions in policing. Hum. Resour. Manag. J. **22**(4), 428–441 (2012)
5. Kinman, G., Grant, L.: Predicting stress resilience in trainee social workers: the role of emotional competencies. Br. J. Soc. Work **41**(2), 261–275 (2011)
6. Clunies-Ross, P., Little, E., Kienhuis, M.: Self-reported and actual use of proactive and reactive classroom management strategies and their relationship with teacher stress and student behaviour. Educ. Psychol. **28**(6), 693–710 (2008)
7. Hastings, R., Bham, M.: The relationship between student behaviour patterns and teacher burnout. Sch. Psychol. Int. **24**(1), 115–127 (2003)
8. Lewis, R.: Teachers coping with the stress of classroom discipline. Soc. Psychol. Educ. **3**, 155–171 (1999)
9. Mann, S.: 'People work': emotion management, stress and coping. Br. J. Guid. Couns. **32**(2), 205–221 (2004)
10. Maslach, C., Leiter, M.P.: Teacher burnout: a research agenda. In: Vandenberghe, R., Huberman, A.M. (eds.) Understanding and Preventing Teacher Burnout: A Sourcebook of International Research and Practice, pp. 295–303. Cambridge University Press, Cambridge (1999)
11. Burke, R.J., Greenglass, E.: A longitudinal study of psychological burnout in teachers. Hum. Relat. **48**(2), 187–202 (1995)
12. Byrne, B.: Burnout: investigating the impact of background variables for elementary, intermediate, secondary and university educators. Teach. Teach. Educ. **7**(2), 197–209 (1991)
13. Griva, K., Joekes, K.: UK teachers under stress: can we predict wellness on the basis of characteristics of the teaching job? Psychol. Health **18**(4), 457–472 (2003)
14. Kyriacou, C.: Teacher stress: directions for future research. Educ. Rev. **53**(1), 27–35 (2001)
15. Chan, D.W.: Stress, self efficacy, social support and psychological distress among prospective Chinese teachers in Hong Kong. Educ. Psychol. **22**(5), 557–569 (2002)
16. Travers, C.J., Cooper, C.L.: Mental health, job satisfaction and occupational stress among UK teachers. Work Stress **7**(3), 203–219 (1993)
17. Unterbrink, T., Hack, A., Pfeifer, R., Buhl-Grießhaber, V., Müller, U., Wesche, H., Frommhold, M., Scheuch, K., Seibt, R., Wirsching, M., Bauer, J.: Burnout and effort-reward imbalance in a sample of 949 German teachers. Int. Arch. Occup. Health **80**, 433–441 (2007)
18. Van Dick, R., Wagner, U.: Stress and strain in teaching: a structural equation approach. Br. J. Educ. Psychol. **71**, 243–259 (2001)
19. Fried, R.: The Passionate Teacher. Beacon Press, Boston (1995)
20. Brennan, K.: The managed teacher: emotional labour, education, and technology. Educ. Insights **10**, 2 (2006)
21. Hargreaves, A.: Mixed emotions: teachers' perceptions of their interactions with students. Teach. Teach. Educ. **16**, 811–826 (2000)
22. Beatty, B.: The emotions of educational leadership: breaking the silence. Int. J. Leadersh. Educ. **3**(4), 331–358 (2000)
23. Hebson, G., Earnshaw, J., Marchington, L.: Too emotional to be capable? The changing nature of emotion work in definitions of 'capable teaching'. J. Educ. Policy **22**(6), 675–694 (2007)
24. Morris, J.A., Feldman, D.C.: The dimensions, antecedents, and consequences of emotional labor. Acad. Manag. Rev. **21**(4), 986–1010 (1996)
25. Philipp, A., Schupbach, H.: Longitudinal effects of emotional labour on emotional exhaustion and dedication of teachers. J. Occup. Health Psychol. **15**(4), 494–504 (2010)

26. Hobfoll, S.E.: Conservation of resources - a new attempt at conceptualizing stress. Am. Psychol. **44**, 513–524 (1989)
27. Bono, J., Vey, M.: Toward understanding emotion management at work: a quantitative review of emotional labor research. In: Hartel, C.E.J., Zerbe, W.J., Ashkanasy, N.M. (eds.) Emotions in Organizational Behavior, pp. 213–233. Lawrence Erlbaum Associates, Marwah (2005)
28. Freedy, J.R., Hobfoll, S.E.: Stress inoculation for reduction of burnout: a conservation of resources approach. Anxiety Stress Coping **6**(4), 311–325 (1994)
29. Hochschild, A.R.: The Managed Heart. University of California Press, Berkeley (1983)
30. Grandey, A.: Emotion regulation in the workplace: a new way to conceptualise emotional labor. J. Occup. Health Psychol. **5**, 95–110 (2000)
31. Yang, F.-H., Chang, C.-C.: Emotional labour, job satisfaction and organizational commitment amongst clinical nurses: a questionnaire survey. Int. J. Nurs. Stud. **45**, 879–887 (2008)
32. Wharton, A.S., Erickson, R.J.: Managing emotions on the job and at home: understanding the consequences of multiple emotional roles. Acad. Manag. Rev. **18**, 457–486 (1993)
33. Chang, M.: An appraisal perspective of teacher burnout: examining the emotional work of teachers. Educ. Psychol. Rev. **3**, 193–218 (2009)
34. Brackett, M.A., Palomera, R., Mojsa-Kaja, J., Reyes, M.R., Salovey, P.: Emotion regulation ability, burnout, and job satisfaction among British secondary-school teachers. Psychol. Sch. **47**(4), 406–417 (2010)
35. Xanthopoulou, D., Bakker, A.B., Demerouti, E., Schaufeli, W.B.: The role of personal resources in the job-demands resources model. Int. J. Stress Manag. **14**, 121–141 (2007)
36. Edwards, J.A., Webster, S., Van Laar, D., Easton, S.: Psychometric analysis of the UK health and safety executive's management standards work-related stress indicator tool. Work Stress **22**, 96–107 (2008)
37. Bolton, S.: Emotion here, emotion there, emotional organisations everywhere. Crit. Perspectives Account. **11**(2), 155–171 (2000)
38. Allen, T.D., Herst, D.E., Bruck, C.S., Sutton, M.: Consequences associated with work-to-family conflict: a review and agenda for future research. J. Occup. Health Psychol. **5**, 278–308 (2000)
39. Bechtoldt, M.N., Rohrmann, S., de Pater, I.E., Beersma, B.: The primacy of perceiving: emotion recognition buffers negative effects of emotional labor. J. Appl. Psychol. **96**, 1087–1094 (2011)
40. Cheng, C., Bartram, T., Karimi, L., Leggat, S.G.: The role of team climate in the management of emotional labour: Implications for nurse retention. J. Adv. Nurs. **69**, 2812–2825 (2013)
41. Ashforth, B.E., Humphrey, R.H.: Emotional labor in service roles: the influence of identity. Acad. Manag. Rev. **18**(1), 88–115 (1993)
42. Medland, J., Howard-Ruben, J., Whitaker, E.: Fostering psychosocial wellness in oncology nurses: addressing burnout and social support in the workplace. Oncol. Nurs. Forum **31**, 47–54 (2004)
43. Acker, G.M.: The effect of organizational conditions (role conflict, role ambiguity, opportunities for professional development and social support) on job satisfaction and intention to leave among social workers in mental health care. Commun. Ment. Health J. **40**, 65–73 (2004)
44. Poghosyan, L., Aiken, L.H., Sloane, D.M.: Factor structure of the Maslach Burnout Inventory: an analysis of data from large scale cross-sectional surveys of nurses from eight countries. Int. J. Nurs. Stud. **46**(7), 894–902 (2009)
45. Demerouti, E., Nachreiner, F., Bakker, A.B., Schaufeli, W.B.: The job demands-resources model of burnout. J. Appl. Psychol. **86**, 499–512 (2001)
46. Vahey, D.C., Aiken, L.H., Sloane, D.M., Clarke, S.P., Vargas, D.: Nurse burnout and patient satisfaction. Med. Care **42**, 57–66 (2004)
47. Rose, J., Glass, N.: An Australian investigation of emotional work, emotional 46 well-being and professional practice: an emancipatory inquiry. J. Clin. Nurs. **19**, 1405–1414 (2010)

48. Panagopoulou, E., Kersbergen, B., Maes, S.: The effects of emotional (non-)expression in (chronic) disease: a meta-analytic review. Psychol. Health **17**, 529–545 (2002)
49. Pugliesi, K.: The consequences of emotional labor: effects on work stress, job satisfaction, and well-being. Motiv. Emot. **23**, 125–154 (1999)
50. Rafaeli, A., Sutton, R.I.: Expression of emotion as part of the work role. Acad. Manag. Rev. **12**, 23–37 (1987)
51. Schaubroeck, J., Jones, J.R.: Antecedents of workplace emotional labor dimensions and moderators of their effects on physical symptoms. J. Organ. Behav. **21**, 163–183 (2000)
52. Kasl, S.V.: Measuring job stressors and studying the health impact of the work environment: a epidemiological commentary. J. Occup. Health Psychol. **3**, 390–401 (1998)
53. Glomb, T.M., Tews, M.J.: Emotional labor: a conceptualization and scale development. J. Vocat. Behav. **64**(1), 1–23 (2004)
54. Kruml, S.M., Geddes, D.: Catching fire without burning out: is there an ideal way to perform emotional labor? In: Ashkanasy, N.M., Härtel, C.E.J., Zerbe, W.J. (eds.) Emotions in the Workplace: Research, Theory, and Practice, pp. 177–188. Quorum Books, Westport (2000)
55. Zhang, Q., Zhu, W.: Exploring emotion in teaching: emotional labor, burnout, and satisfaction in Chinese higher education. Commun. Educ. **57**(1), 105–122 (2008)
56. Deery, S., Iverson, R., Walsh, J.: Work relationships in telephone call centres: understanding emotional exhaustion and employee withdrawal. J. Manag. Stud. **39**(4), 471–475 (2002)
57. Grandey, A.A., Tam, A.P., Brauburger, A.L.: Affective states and traits in the workplace: diary and survey data from young workers. Motiv. Emot. **26**, 31–55 (2002)
58. Bolton, S., Boyd, C.: Trolley dolley or skilled emotion manager? Moving on from Hochschild's 'emotional labour' Work. Employ. Soc. **17**(2), 289–308 (2003)
59. Jones, F., Bright, J.: Stress: Myth, Theory and Research. Prentice Hall, London (2001)
60. Cohen, S., Wills, T.A.: Stress, social support and the buffering hypothesis. Psychol. Bull. **98**(2), 310–357 (1985)
61. Beehr, T.A., Jex, S.M., Stacy, B.A., Murray, M.A.: Work stressors and co-worker support as predictors of individual strain and job performance. J. Organ. Behav. **21**, 391–405 (2000)
62. Zellars, K.L., Perrewé, P.L.: Affective personality and the content of emotional social support: coping in organizations. J. Appl. Psychol. **86**, 459–467 (2001)
63. Brotheridge, C.M., Grandey, A.A.: Emotional labor and burnout: comparing two perspectives of 'people work'. J. Vocat. Behav. **60**(1), 17–39 (2002)
64. Anderson, N.R., West, M.A.: Measuring climate for work group innovation: development and validation of the team climate inventory. J. Organ. Behav. **19**, 235–258 (1998)
65. Cammann, C., Fichman, M., Jenkins, D., Klesh, J.: The Michigan Organisational Assessment Questionnaire. Unpublished manuscript, University of Michigan, Ann Arbor, Michigan (1979)
66. Hair, J.F., Black, W.C., Babin, B.J., Anderson, R.E.: Multivariate Data Analysis, 7th edn. Prentice Hall, Upper Saddle River (2010)
67. Kline, T.J.B., Dunn, B.: Analysis of interaction terms in structural equation models: a non-technical demonstration using the deviation score approach. Can. J. Behav. Sci./Revue canadienne des sciences du comportement **32**(2), 127–132 (2000)
68. Chrisopoulos, S., Dollard, M., Winefield, A., Dormann, C.: Increasing the probability of finding an interaction in work stress research: a two-wave longitudinal test of the triple-match principle. J. Occup. Organ. Psychol. **83**(1), 17–37 (2010)
69. Brotheridge, C.M., Lee, R.T.: Testing a conservation of resources model of the dynamics of emotional labor. J. Occup. Health Psychol. **7**(1), 57–67 (2002)
70. Martínez-Iñigo, D., Totterdell, P., Alcover, C.M., Holman, D.: Emotional labour and emotional exhaustion: interpersonal and intrapersonal mechanisms. Work Stress **21**, 30–47 (2007)

71. Bartram, T., Casimir, G., Djurkovic, N., Leggat, S.G., Stanton, P.: Do perceived high performance work systems influence the relationship between emotional labour, burnout and intention to leave? A study of Australian nurses. J. Adv. Nurs. **68**, 1567–1578 (2012)
72. Leiter, M.P., Maslach, C.: The impact of interpersonal environment on burnout and organizational commitment. J. Organ. Behav. **9**, 297308 (1988)
73. Mann, S., Cowburn, J.: Emotional labour and stress within mental health nursing. J. Psychiatr. Ment. Health Nurs. **12**(2), 154–162 (2005)
74. Zwart, R.C., Wubbels, T., Bergen, T.C.M., Bolhuis, S.: Experienced teacher learning within the context of reciprocal peer coaching. Teach. Teach. Theory Pract. **13**(2), 165–187 (2007)

Accountability in Assertive Decisions Making

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Abstract. This scientific investigation is a proposal regarding managerial skills for decision making, in the context of emotional intelligence. The objective is to investigate the influence that accountability has on assertive decision-making in all areas and at all hierarchical levels of an SMB in the hospital sector in Tijuana, Baja California, México. The approach is qualitative in phenomenological design, carried out on 10 collaborators: 54.5% operative personnel, 18% support personnel, and 27.5% administrative area. The measurement instruments are focus groups and questionnaires to measure accountability. The data analysis is using descriptive statistics, SPSS version 22 program, and coding tables. The results show that 100% of the collaborators are not aware of the responsibility of the daily decisions and sometimes, the decision-maker prefers not to decide especially for fear of punishment. It is concluded that it is necessary to design an accountability model as a part of the continuous training requirements.

Keywords: Accountability · Assertive decision-making

1 Introduction

Every day, the world is changing; uncertainty has to be the main factor to consider in the impact of decisions that today, need to be fast and assertive.

Usually, entrepreneurs only consider decision-making as a process, leaving aside the human factor that can modify according to their experience, knowledge, confidence, and values the result of it, affecting directly in the results of the organization [1].

In order to achieve competitiveness, organizations need to make quick and assertive decisions in an ever-changing environment [2]. Strategic value creation in organizations is generated in strategic decision-making processes [2].

To achieve an accountability organization, it is necessary to encourage communication at all hierarchical levels of the organization. Communication fulfills a number of functions in the organization, such as: providing information on internal processes, enabling command functions, decision-making, problem solutions, and diagnosis of reality [4].

AHMC is a health sector SMB, founded in Tijuana, Baja California, Mexico, in 2010, in order to fill the need for the International Medical Tourism market.

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To achieve the results, be competitive and get the desired performance, for three years, AHMC has been given the task of designing and implementing training plans and feedback mechanisms to its collaborators for assertive decision-making, however, it has been observed that for about a year and a half, the lack of accountability in the decision-making of the collaborator (among other causes), is a factor that limits the choice and decision-making, affecting on the competitiveness and profitability of the organization. This lack of accountability produces failures in communication with affectation in timely deliveries, customer service, generation of waste, and emergency purchases at a not agreed price, to mention a few examples, directly impacting the profitability of the organization.

This research aims to determine the impact of accountability on assertive decision-making at AHMC.

2 Methodology

In Tijuana, Baja California, México. Postgraduate research has generated contributions to the state of the art in research methodologies on the frontier of innovation, for the benefit of society, such as the case of the Fifth Systemic Helix (FSH) in Spanish known as Quinta Hélice Sistémica (QHS), based on focus group techniques for sector integration studies and evaluation of public policies [5–7].

The approach is qualitative in phenomenological design and pretended to know, in depth, the perspective of the decision-making in its field of work, so more than exact variables, are required to know concepts whose essence is not only captured through quantitative measurements [8].

This investigation is carried out on 10 collaborators, with no age limit, gender, department, or hierarchical level and who are active during the period of the investigation. 80% of study subjects are female, with a scholarship from elementary to undergraduate. 40% of employees have more than 5 years working in the organization, with antiquity from 28 days to 9 years and with an age from 21 to 48 years, being an average of 32 years. 54.5% operative staff and 18% support personnel.

The measurement instrument, which consists of 10 closed questions with a 5-point scale with multiple options in Likert scale (“never”, “almost never”, “sometimes”, “often” and “always”), adapted from Partners in Leadership and modified by the author of this investigation. The questionnaire consists of a series of questions in which the subject must choose the option which they most identify with. The instrument is based on the self-assessment “seeing it” from The Principle of Oz [9] [Connors et al. 2016]. The goal is that the subject determines the ability to recognize the attitudes and behaviors in the face of a failure to make decisions.

To know the perspective from the experience of the research participants, a focus group with participatory observation is conducted, which is recorded and transcribed. The purpose is to know the influence of accountability on decision-making and its impact on the interaction areas.

SPSS program version 22 is used in responsibility questionnaire. Focus group results are analyzed through coding box to be subsequently plotted in the excel program for presentation.

3 Results

3.1 Accountability Questionnaire

The accountability questionnaire is applied to know whether the participant is accountable and assumes responsibility for the decision he made and if he has the perspective to determine the impact of the decision on other areas of the organization.

67% of the participants are not being responsible about the consequences of their decisions making and do not try to do it ever [see Table 1].

Table 1. When you have a problem, do your effort into understand it, taking into account all the points of view and people or areas involved?

		Frequency	Percentage	Validated percentage	Accumulated percentage
Valid	Sometimes	1	11.1	11.1	11.1
	Often	5	55.6	55.6	66.7
	Always	3	33.3	33.3	100
	Total	9	100.0	100.0	

(Source: own elaboration [2020]. Accountability questionnaire. SPSS 22 version.)

67% of the participants do not accept the responsibility of their decisions in order to problem solving, choosing the best alternative [see Table 2].

Table 2. Are you willing to accept existing problems and understand the consequences of not solving them?

		Frequency	Percentage	Validated percentage	Accumulated percentage
Valid	Never	1	11.1	11.1	11.1
	Rarely	1	11.1	11.1	22.2
	Often	4	44.4	44.4	66.7
	Always	3	33.3	33.3	100.0
	Total	9	100.0	100.0	

(Source: own elaboration [2020]. Accountability questionnaire. SPSS 22 version.)

67% of the participants are not conscientiously of their acts and in consequence, do not realize about the decision-making process [see Table 3].

Table 3. Are you consciously objective of the responsibility of your acts and decisions?

		Frequency	Percentage	Validated percentage	Accumulated percentage
Valid	Sometimes	1	11.1	11.1	11.1
	Often	5	55.6	55.6	66.7
	Always	3	33.3	33.3	100
	Total	9	100.0	100.0	

(Source: own elaboration [2020]. Accountability questionnaire. SPSS 22 version.)

67% of the participants do not accept the responsibility when they generate a failure [see Table 4].

Table 4. When somebody explains to you that you are responsible for generating a failure, are you consciously about how you contributed in it?

		Frequency	Percentage	Validated percentage	Accumulated percentage
Valid	Sometimes	3	33.3	33.3	33.3
	Often	3	33.3	33.3	66.7
	Always	3	33.3	33.3	100
	Total	9	100.0	100.0	

(Source: own elaboration [2020]. Accountability questionnaire. SPSS 22 version.)

3.2 Focus Group

The focus group was done to determine the way that the decision-maker is assuming the responsibility and what factors could be limiting the assertive decision-making.

In 50% of cases, the limiting factor of greatest influence to assume responsibility for decision-making is not knowing how to prioritize actions, followed by lack of experience by not facing the same situation in their experience and lack of communication [see Fig. 1].

4 Conclusions

According to the results obtained, it is determined that the collaborators do not assume responsibility for decision-making, firstly because they do not realize or not accept that they have flaws at the time of deciding and consequently, as a second point they are not able to realize the impact that these decisions have in other areas in which they interact.

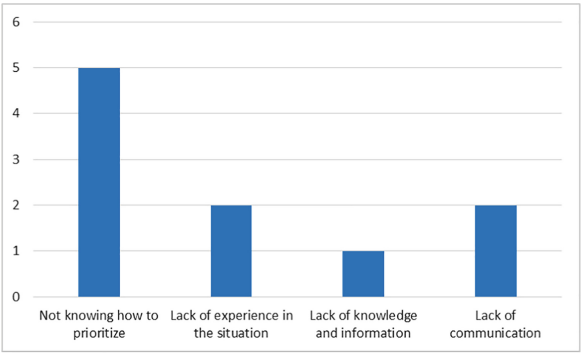

Fig. 1. Factors that limit accountability in assertive decision-making. Source: owner [2020]. Result of focus group: accountability in decision-making.

Assertive decision-making directly impacts the competitiveness and profitability of organizations. The operative staff takes decisions the day-to-day and they are not conscious about it.

The proposal is to make a model that includes in each position profile, decision-making and the level of responsibility as part of the skills at all hierarchical levels as part of the training program for each time a new contributor enters and when a job promotion is held. As well as to integrate as part of induction training, a program in accountability.

The influence of the leadership of SMB in the hospital sector reflects the success of the image of quality services and care in Tijuana, Baja California, Mexico.

References

1. Bonilla, A.: Doctoral thesis work in process: the influence of self-esteem on the accountability of assertive decision-making. Case AHMC. La influencia de la autoestima en la toma de decisiones asertivas. Caso AHMC. Escuela de Negocios del Pacifico, Tijuana (2020)
2. Rodríguez, Y.: Model of use of information for strategic decision-making for decision-making in Cuban information organizations. Modelo de uso de información para la toma de decisiones estratégicas para la toma de decisiones en organizaciones de información cubanas. Tesis doctoral, Doctoral thesis, Universidad de Granada. Granada, Cuba (2014)
3. Sosa, R.: Accountability the ability to fulfill the work plans. La capacidad de cumplir planes. Revista Forbes México (2018). https://www.forbes.com.mx/accountability-la-capacidad-de-cumplir-planes/
4. Trista, P.: The organizational communication. La Comunicación en las Organizaciones. Revista Cubana de Educación Superior. No. 2 (2004)
5. Martínez, R.: Fifth Systemic Helix (FHS). A method to evaluate the international competitiveness of electronics sector in Baja California, Mexico (2012). Quinta hélice sistémica (QHS). Un método para evaluar la competitividad internacional del sector electrónico en Baja California, México (2012). Investigación Administrativa, (110), 34–48 (2012). [fecha de consulta 28 de abril de 2020]. ISSN: 1870-6614. Disponible en. https://www.redalyc.org/articulo.oa?id=4560/456045338003
6. Martínez Gutiérrez, R.: Fifth systemic helix (FSH), a model for the development of public policies. Cooperativismo Desarrollo **20**(101), 1 (2012). https://revistas.ucc.edu.co/index.php/co/article/view/17

7. Martínez-Gutierrez, R.: Methodology of the fifth systemic helix for the development of public sector policies. J. Compet. Stud. **22**(3–4), 147+ (2014). https://www.questia.com/library/journal/1G1-427666157/methodology-of-the-fifth-systemic-helix-for-the-development
8. Hernández, R., Fernández, C., Baptista, M.: Research Methodology. Metodología de la investigación. McGraw-Hill/Interamericana Editores, SA de CV, Ciudad de México, México (2014)
9. Connors, R., Smith, Hickman, C.: The Oz Principle. El Principio de Oz. Editorial Paidós. Buenos Aires, Argentina (2016)

Sales and Marketing

Econometric Modeling of the Performance in the City Council of Chile

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Abstract. In Chile, the city councils are fundamental to the country's decentralization, by introducing a more connected route of administration for and along with people, their problems, needs and desires to develop themselves. For the above, the elements that make it efficient and improve the quality of citizens' life are essential. There are 346 city councils in Chile which belong to the different communes, for the following research there were selected the ones that have more than 50,000 habitants and that belong to regional capitals. So that the factors that influence the efficiency of the city council in Chile were determined, from the index of quality of life of the communes. Therefore, there was developed an econometric model which explained the determined factors for the efficiency of the city council in Chile. Moreover, there were identified the variables that have a greater impact on such efficiency.

Keywords: Econometric model · City council · Efficiency · Life quality

1 Introduction

City Council in Chile are fundamental in the decentralization of the country, representing a more connected route of administration to and with people, their problems, needs and desire to develop. Therefore, the elements that make it efficient and improve the quality of life of citizens are key.

This paper aims to identify determinants of city council efficiency belonging to the different communes of Chile, based on different variables of the literature related to city councils, which are subjected to a quantitative and stochastic analysis to determine which of them are the explanatory ones of the endogenous variable, based on the urban quality of life index of the communes, which is an indicator that contemplates different objective dimensions related to city council and therefore overcome reductionist models that are only based on management.

Law No. 18.695 Organic Municipalities defines city councils as "autonomous corporations of public law, with legal personality and own heritage, whose purpose is to meet the needs of the community in economic, social and cultural progress" [1].

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These organizations will have as the highest authority the mayor with their respective council. In the country there are 346 communes of which there are 345 city councils.

There is now a growing interest in city councils due to the search for decentralization in Chile, as excessive centralism in the economic, political and administrative fields of the country is known compared to other Latin American countries, but more importantly, the OECD itself recommends strengthening the regions so as not to slow the country's development any further, which can only be carried out through efficient city councils. In addition to this, the city councils must be able to meet the needs of the community in different areas, which takes on true meaning for people with fewer resources who can take advantage of the benefits they deliver and who are the most harmed when they don't work optimally. Despite this, there are not many studies around city councils, most or are from other countries, historical or have an emphasis on only a few aspects, moving away from a more global econometric assessment of determining factors.

Furthermore, currently studying the reality of the municipalities in Chile is essential, due to the imminent and historic constitutional process that the country will begin in 2020. This constitutional instance seeks to overcome an unexpected social and political crisis that erupted in October 2019, which it generates expectation and uncertainties at the South American and international level, about the future of a democracy that had behaved with stability during the last 30 years.

In effect, despite the sustained loss of confidence of citizens towards national and state institutions in Chile, municipalities are still perceived in public opinion studies as spaces of closeness, participation and conflict resolution. The city councils will be territorial enclaves that will seek to strengthen themselves in the face of what may even culminate in a new design of the Chilean political system.

Due to the need for greater local empowerment in Chile, the first popular election of regional governors in history will also take place in 2021. It is essential to know the efficiency of the municipalities and the variables studied, in order to project how these will relate from the political and social management, with new territorial authorities that will not be appointed by a current president.

2 Theoretical Framework

In Chile there are 346 city councils belonging to the different communes, of which for our research were selected those that have more than 50,000 inhabitants and belonging to regional capitals. The factors influencing the efficiency of city councils in Chile were determined, based on the quality of life index of the communes. For the above, an econometric model was developed that explained the determinants of the efficiency of city council in Chile. In addition, variables that have the greatest impact on such efficiency were identified.

The implications found in the efficiency model of city councils, they realize that there is currently a growing interest in city councils due to the search for decentralization in Chile, since excessive centralism in the fields of the country's economic, political and administrative countries compared to other Latin American countries, but more importantly, the OECD itself recommends strengthening the regions so as not to continue to slow down the country's development, which can only be carried out through efficient

city councils. Therefore, reaching out to the factors that determine city council efficiency is of high interest as it shows us the aspects that require special attention, which under the hand of new public policies focused on these would tend to increase the good perception management of city councils as well as, and more importantly, the quality of life of people.

The efficiency of city council in Chile within the present work relates in different ways to the following variables, belonging to the final model exposed (Table 2), such as the Municipal Common Fund (FCM), Permanent Own Income (IPP), density, intra-family violence rate, average PSU and overcrowding.

1. Municipal Common Fund (FCM)
   It is defined as the mechanism of solidarity redistribution of own income among the city councils of the country, which could have a negative effect on the efficiency of city council, all by arguing that the costs are in line with the resources and do not translate into a greater and better provision of public services [2], which in the literature has been called the "flypaper effect" [3].
2. Permanent Own Income (IPP) [4]
   It corresponds to the budget of a city councils, which will be composed of the following accounts of the budget classifier: territorial tax, municipal benefit movement permits, municipal benefit patents, grooming rights, other rights, property rents, driver's licenses and the like, fines and interests, concessions, aquaculture patents, mining patents and casinos, so, and based on literature, [5] remain that at a higher level of income, it produces that increase the fiscal capacity of municipalities, which could increase the likelihood that politicians and bureaucrats will perform inefficiently. Another variable considered within the determination of Permanent Own Income (IPP) and which could have a negative impact on the efficiency of municipalities is the fiscal deficit, considering that, in the event of an excess of expenditure on municipalities would expose a municipality to a situation of financial vulnerability [6].
3. Population Density
   It is the population density, considering for these purposes, the number of inhabitants per km^2, that both [7] have shown that a smaller number of inhabitants per square kilometer can increase the average cost of supplying goods and services, so that a municipality could be more efficient if its population density was higher.
4. Intrafamily Violence Rate
   It corresponds to the rate of complaints of domestic violence offences per 100,000 inhabitants who, based on studies on the subject, it can be supported that such violence presented in a given individual, being able to present itself in its various forms, ultimately harms health and quality of life indistinctly in the world, this being supported by UNICEF, where as part of the definition it provides for "domestic violence", it contemplates the grievance to quality of life [8].
5. Average PSU
   It is defined as the percentage of PSU Scores equal to or greater than 450 points in municipal establishments, of which for the purposes of this research it was worked under the assumption that each citizen who takes the University Selection Test (PSU) has a certain level of education and that he could potentially choose to improve that

level, which according to [7] determined that the variable of citizen participation, being approximated by the educational level of the adult population, has a positive impact on the degree of city council efficiency. In this same line is that [6, 7, 9], reinforce these results.

6. Overcrowding
   It corresponds to the average level of overcrowding in households, with this variable being expressed as a percentage, where the overcrowding would be the result of the absence of adequate urban development, i.e. infrastructure and housing, which would lead to a decrease in minimum quality of life conditions for the individuals who make up a particular commune. [10] showed as to those factors that influence the efficiency of municipalities, as "another different type of factor that can influence the efficiency of municipalities", the characteristics of local residents, the different types of overcrowding levels that residents of a commune may experience as part of these characteristics.

City Council efficiency or inefficiency can be explained by factors of various kinds, the literature has concentrated mostly on the fiscal, socioeconomic and demographic aspects as explanatory factors of the levels of city council efficiency. While such studies may focus on the factors already mentioned, the literature with respect to the city council and the factors that affect it, has the characteristic of being scarce and of being outdated, also considering only a few factors for the determination of efficiency, so many of the proposed models have a special interest in resources, while there are authors who argue that a person's material well-being and quality of life [11] they do not have a direct correlation, varying this relationship by the income level of individuals, satisfaction or dissatisfaction of basic needs and other factors [12], where [13] mentions that the interrelationship between needs, satisfactory and economic goods, being this interrelationship of a permanent and dialectical type, triggers a dialectic hysterical, where on the one hand economic goods have the capacity to affect the efficiency of satisfactory, these, on the other hand, will be decisive in the generation and creation of those, so, and considering that the municipalities are responsible for the administration of economic goods, obtained by the redistribution of resources, and whose management has a direct impact on efficiency, considering the factors that influence the quality of life as a whole of the satisfactory, is relevant when planning and budgeting in each municipality.

The assumptions raised according to the different authors are that as we move from the north to southern Chile, there are better indicators [14], and that the best indicators are in the central area of the country, as well as [2, 7, 15] suggest that the higher the population density of the commune, the more efficient the municipality will be. These hypotheses will be tested from the proposed final model and may also conclude the behavior of municipalities in Chile, and if they have any relation to what is raised according to the literature.

3 Methodology

Regarding the literature, city council efficiency analysis studies are conducted in general around microeconomic theory, evaluating municipal efficiency based on two aspects,

inputs and product, considering it efficient to the extent that it reaches its maximum level of production compared to certain inputs and the minimum level of inputs at a given product level [10, 16]. On the other hand, studies on city council efficiency in Chile are scarce and of the few jobs that exist are not very up-to-date or have a special interest in resources, leaving aside other important dimensions.

Regarding the methodology of the work, the analysis was carried out to a total of 93 communes in Chile, covering the North, Central and South areas of the country, using cross-sectional variables that influence municipal efficiency, and through stochastic analysis, identifying those that are decisive and thus exposing the aspects that significantly influence through an econometric model of simple regression [17–19] which is validated by the assumptions of the waste before proceeding with the second objective, which is the estimation and interpretation of results [20, 21].

4 Results and Discussion

For the build the database to be used to forecast the efficiency of city council in Chile [22], is that the National Municipal Information System was consulted, together with the Library of the National Congress of Chile (BCN), in order to be able to predict the efficiency of municipalities, which for their determination an approximation based on the Urban Quality of Life Index (ICVU) for the year 2018 was used, considering for these purposes the different areas of the country. The model estimate specified in Eq. 1 is presented in the following Table 1.

Table 1. Estimation of general model parameters.

Variable	Coefficient	Std. error	t-Statistic	P-Value
Domestic violence	−0.012964	0.004200	−3.086408	0.0028
Health budget	0.076376	0.053567	1.425805	0.1579
Scholarship	−0.000210	8.57E−05	−2.445162	0.0167
IPP	2.89E−07	1.05E−07	2.752694	0.0073
Other incomes	−3.70E−07	2.59E−07	−1.431423	0.1563
FCM	1.64E−07	2.15E−07	0.762711	0.4479
Density	−0.000564	0.000130	−4.355540	0.0000
Green areas	1.84E−06	1.15E−06	1.598367	0.1140
Average PSU	12.81732	4.457474	2.875466	0.0052
Overcrowding	−57.43565	18.52834	−3.099881	0.0027
Poverty	−22.91616	13.88977	−1.649859	0.1030
C	59.64198	4.667443	12.77830	0.0000

Source: Own creation by means of EViews statistical program.

After estimating the tentative model, considering for these purposes, all the variables studied for the determination of the quality of life of the inhabitants of a commune as the

efficiency of the city council in Chile, is that the variables relevant to the determination of the study approach were selected, such as municipal efficiency, considering for these purposes those variables that were greater than the minimum level[1] of confidence adopted for this study, being eliminated of the model, which in addition to this method, is that it was considered what was stated by the literature in question and its influence on the meaningless and determination of the endogenous variable.

After the elimination of the variables mentioned above, a final econometric model is proposed that better represents those factors that affect the efficiency of the city councils in Chile (Table 2).

Table 2. Final model parameter estimation

Variable	Coefficient	Std. Error	t-Statistic	P-Value
Domestic Violence	−0.013222	0.004051	−3.263793	0.0016
IPP	1.12E−07	3.26E−08	3.433896	0.0009
FCM	−2.15E−07	7.71E−08	−2.789977	0.0065
Overcrowding	−79.50409	17.53457	−4.534135	0.0000
Average PSU	16.36778	4.456570	3.672732	0.0004
Density	−0.000430	0.000117	−3.668260	0.0004
C	59.43797	4.688335	12.67784	0.0000

Source: Own creation by means of EViews statistical program.

Based on the results obtained in Table 2 we can see significance levels at 90%, as well as 99% levels of joint significance. The variability of the efficiency of city council in Chile based on the Quality of Life Index (ICVU) is explained by 71% by the variability of variables: Density, Average PSU, Overcrowding, Municipal Common Fund (FCM), Permanent Own Income (IPP) and the rate of Domestic Violence. As for the hypotheses associated with the residues of the model, being able also to compare its behavior according to Fig. 1, they do not present problems of self-correlation of the residues, using the Breusch-Godfrey test[2] (Table 3), nor problems of normality of the residues[3], nor problems of heteroscedasticity (Table 4) of the aforementioned mentioned[4].

[1] P-value ≤ 0.1.

[2] Breusch-Godfrey test; p-value ≤ 0.1.

[3] Jarque-Bera Test 4,4654; P-values 0.1072.

[4] White Test - F-statistic: 0.4629; P-values 0.9852.

Table 3. Breusch-Godfrey serial correlation LM test.

F-statistic	0.391564	Prob. F(2,82)	0.6773
Obs*R-squared	0.860859	Prob. Chi-Square(2)	0.6502

Source: Own creation by means of EViews statistical program.

Table 4. Heteroscedasticity white test.

F-statistic	0.462869	Prob. F(27,63)	0.9852
Obs*R-squared	15.06367	Prob. Chi-Square(27)	0.9685
Scaled explained SS	15.65709	Prob. Chi-Square(27)	0.9592

Source: Own creation by means of EViews statistical program.

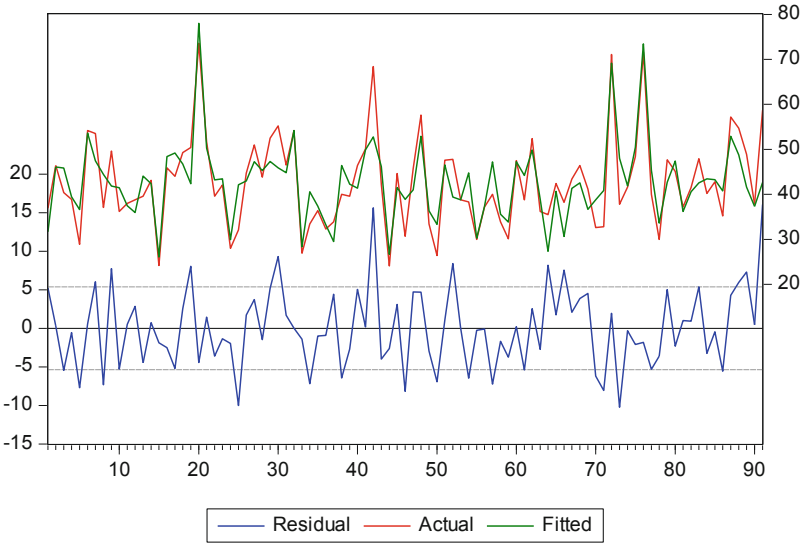

Fig. 1. Waste from the final model Source: Own creation by means of EViews statistical program.

As illustrated by Fig. 1, you can see the distribution of the residuals, considering the data obtained through ICVU, as the estimation of efficiency through the final model proposed, being the difference illustrated by means of the graph explained by the R^2 adjusted for the 71.29% model.

5 Conclusions

This research provides us to make contrasts between different municipalities, which makes us reach conclusions regarding the current situation at the level of areas of the country, this is North, Central and South, as it also allows us to find and tore down certain prejudices, such as the centralization of the country, showing the variables that affect in greater proportion according to our econometric model and raising new aspects to consider in municipal management.

As already raised through the present paper, there are authors who propose that quality of life can be decoded from economic growth, the latter being in many cases considered as a factor in determining efficiency within municipalities, but rather propose that such quality must ultimately be decoded by development considered as optimizing environmental and social efficiency. In this sense [23] mention that in this area it is not only necessary to consider those factors that allow a certain degree of "greening" of the economy, but also the linking of the economy to politics, establishing through the latter a set of criteria of equity and distribution, which tend to reduce interterritorial imbalances, considered as elements of high entropy, that is, in relation to an improvement of the quality of life, that is to say, of the inhabitants of a certain territory through those who manage the resources, such as city councils, is that they must not only simply worry about economic variables such as the Municipal Common Fund (FCM) and Permanent Own Income (IPP), but also consider, for example, the domestic violence that is held in a certain commune, which are rather social.

Therefore, it is that, although in economic matters to population density can increase the efficiency of city councils, in terms more linked to the quality of life of the inhabitants belonging to a certain commune, it tends this factor to slightly decrease that efficiency, counteracting to some level what was raised by the literature, in which [21] rectifies the fact that the changes produced by development with economic accumulation or with the structural transformation in human development, in a framework of study of the quality of life and how the environment, and ultimately the changes that occur in this, can contribute positively or negatively in each individual, thus confusing the necessary and sufficient conditions, that is, how the administration and management of resources, which contribute to the efficiency of city councils in Chile affect the quality of life of the inhabitants in each of the communes under study, concluding by means of the data, the results and the existing literature, which both factors mentioned are very closely related.

As for the assumptions raised, as are there are better indices in the central area of the country and that there is an increase in rates as we move from north to south of Chile, it can be concluded that, as observed by the ICVU through its graphs, and as predicted by the model, is that both hypotheses are accepted.

Finally, through this study it was concluded that determining the efficiency levels of city councils using only economic factors, is to narrow the information available only to a group of factors, leaving aside the characteristics of the individuals that make up the communes, and that if they consider the quality of life that they possess, as well as their characteristics, could provide a more integrated and real result regarding the efficiency of city councils in Chile and their administration of resources, so, and supporting us in the variables that make up the final model of this research, it can be shown that both economic factors typical of the management of resources that must be carried out by

the red city councils in the country as well as factors that characterize the population, make there a greater concern of those determinants that influence the quality of n the inhabitants and their real impact on efficiency, manage from this increasing politically for and for people.

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References

1. National Congress Library [BCN]: Law No. 18.695 Organic and Constitutional Municipalities (2006). http://bcn.cl/1uuy
2. Sampaio de Sousa, M., Stosic, B.: Technical efficiency of the Brazilian Municipalities: correcting non-parametric frontier measurements for outliers. Working Paper No. 294, Department of Economics University of Brasilia (2003)
3. Hamilton, B.: The flypaper effect and other anomalies. J. Public Econ. **22**, 347–361 (1983)
4. National Municipal Information System [SINIM]: Budget Review (2016). http://www.sinim.gov.cl/archivos/home/597/Revista_Presupuestaria_SINIM_Junio_2016.pdf
5. Silkman, R., Young, D.: X-efficiency and state formula grants. Nat. Tax J. **35**, 383–397 (1982)
6. Balaguer-Coll, M., Prior, D., Tortosa-Ausina, E.: On the determinants of local government performance: A two-stage nonparametric approach. Working Paper No. 3, Centre for Applied Economic Research (2003)
7. De Borger, B., Kerstens, K.: Cost efficiency of Belgian local governments: a comparative analysis of FDH, DEA, and econometric approaches. Reg. Sci. Urban Econ. **26**, 145–170 (1996)
8. UNICEF Chile: Domestic Violence (2019). https://unicef.cl/web/prevencion-de-la-violencia/violencia-intrafamiliar/
9. Loikkanen, H., Susiluoto, I.: Cost efficiency of finnish municipalities in basic service provision 1994–2002. ERSA Conference Papers No. 5, European Regional Science Association (2005)
10. Pacheco, F., Sánchez, R.Y., Villena, M.: Efficiency of local governments and their determinants: an analysis of stochastic borders in panel data for Chilean municipalities. Directorate of Budgets of the Ministry of Finance, vol. 9, p. 23 (2013)
11. Diener, Sandvik, Seidlitz, Diener (1993), Easterling (1995), Diener and Rahtz (2000): In: Diener, E., Rahtz, D.R. (eds.) Advances in Quality of Sand Theory and Research. KIuwer, Dordrecht (2000)
12. Ardila, R.: Quality of life: an integrative definition. Latin Am. J. Psychol. **35**(2), 161–164 (2003)
13. Max-Neef, M., et al.: Development at human level - an option for the future', development dialogue, special issue. CEPAUR et Dag Hammarskjold Foundation, Uppsala (1986)
14. National Municipal Information System [SINIM] (2016). http://www.sinim.gov.cl/archivos/home/597/Revista_Presupuestaria_SINIM_Junio_2016.pdf. Budget Magazine
15. Sheriff, J.: Quality of Life and urban praxis: new citizen management initiatives on the social periphery of Madrid. Sociological Research Center, Monograph Collection 179 (2000). ISBN 84-7476-308-8
16. Herrera, P., Francke, P.: Analysis of the efficiency of municipal expenditure and its determinants **33**(63), 113–178 (2009)
17. Coughenour, C., de la Fuente, H., Paz, A.: Analysis of self-reported walking for transit in a sprawling urban metropolitan area in the western U.S. Sustainability **11**(3), 852, 16 p. (2019). https://doi.org/10.3390/su11030852

18. Paz, A., de la Fuente, H., Singh, A., Conover, R., Monteiro, H.: Highway expenditures and associated customer satisfaction: a case study. Math. Probl. Eng. **2016**, 4630492, 9 p. (2016). https://doi.org/10.1155/2016/4630492
19. De la Fuente, H., Vallina, A.M., Solis, R.: Stochastic analysis of the economic growth of OECD countries. Econ. Res. Ekonomska Istraživanja (2019). https://doi.org/10.1080/1331677X.2019.1685397
20. De la Fuente, H., Rojas, J.L., Leiva, V.: Econometric modeling of productivity and technical efficiency in the Chilean manufacturing industry. Comput. Ind. Eng. **139**(2020), 105793 (2020). https://doi.org/10.1016/j.cie.2019.04.006
21. Coughenour, C., Paz, A., De la Fuente, H., Singh, A.: Multinomial logistic regression to estimate and predict perceptions of bicycle and transportation infrastructure in a sprawling metropolitan area. J. Public Health **38**(4), e401–e408 (2016). https://doi.org/10.1093/pubmed/fdv179
22. Library of the National Congress [BCN]: Law No. 18.695 Organic and Constitutional Municipalities (2006). http://bcn.cl/1uuy1
23. Daly, H.E.: For operational principles of sustainable development. Alfoz. Ecol. Econ. **96**, 27–30 (1990)

The Effects of Leadership and Management to Organizational Atmosphere and the Impact to Cash Flow Earnings: A Study from SME-Companies in Finland

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Abstract. Due to organizational atmosphere being a very broad entirety, which extends practically to all activities and levels of the organization, it can be considered a strategic matter. Good organizational atmosphere shows off, among other things, as an employee's satisfaction and empowerment, which increases organizations abilities to innovate and enhance customer satisfaction. Those can be measured with cash flow earnings.

This article shows trough a study, made in several Finnish SME-companies, a different way to measure performance and success. The good organizational atmosphere has huge impacts for the financial performance of the company as the article will show. Article also answers to questions how and why cash flow earnings is a good and relevant way to measure success and performance. The future research actions and needs are handled and addressed in the end of the article.

Keywords: Cash flow earnings · Management · Leadership · Organizational atmosphere · Wellbeing at work · Measuring performance

1 Introduction

The critical period of work surroundings and work life has already started. Technological development, globalization, generational changes in work life and the increasing

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economical sustainability gap are all behind this period. The whole work culture, management and leadership is challenged [1]. Schwab points out that the ongoing critical period and changes that are happening, affect to every sector from inventing new types of models for making business to all the way to the new ways of production, transportation, consumption and distribution systems. Social changes in how we communicate and operate, inform and even entertain ourselves are in front of everyone [2].

According to Goleman human factors are coming more and more important in business world [3, 4]. Management and leadership have a strong influence on human factors, and that way to wellbeing and performance of the employees [5]. Basically, management and leadership have a crucial effect to organizational atmosphere. Organizational atmosphere is connected to the cash flow earnings as this study shows. Employees are the cornerstones of the organizations and they have a great potential to enhance organizational performance, as a wellbeing and empowered employee is more efficient and effective [5].

There are many ways how measure organizational success and for example the profit and loss statement point of view is one of them. Unfortunately, the profit and loss statement raise a challenge in many cases when organizations fail to recognize the difference between good organizational results and short-term sub-optimization. In other words, in many cases organizations forget to consider how they are going to survive in the long run [5]. Cash flow earnings in the other hand tells purely, from monetary point of view, how much the organization have cash to use for stock buybacks, new investments, dividends and dept repayment [6]. Because it is clearly stated what organizations can do with cash flow earnings, it can be considered as a good way for measuring side by side with profit and loss statement.

2 Towards Strategy with Organizational Atmosphere

Organizational atmosphere can be used to describe the overall situation existing among the people of the organization. Basically, it is a way to describe the wellbeing of the organization from the humane point of view, affected by human factors. Due to organizational atmosphere affects to all levels and all activities of the organization it should be thought as a strategic matter [5, 7]. More we focus on the entirety of the organization, more towards strategic point of view we are heading.

The organizational performance in the other hand can be used to describe the organizations way to perform its responsibilities [5]. The output of the organization can be measured from many different ways, but in the end the organizations capability to perform is the one that has most affect.

2.1 Organizational Atmosphere: From Operational Towards Strategic Matter

Figure 1 shows the path how the overall wellbeing of organization builds up and where in the line of operational-strategic matter the job satisfaction, wellbeing at work and organizational atmosphere are placed.

The foundation of atmosphere is the feeling of the individual. Job satisfaction is basically the individuals own feeling and assessment of the work itself, from the workplace and from the community of the organization [8].

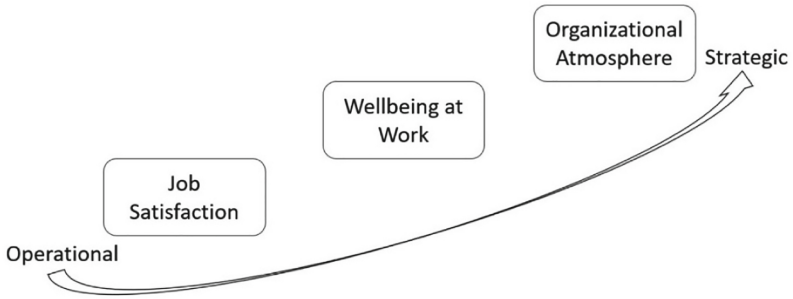

Fig. 1. Overall wellbeing of organization in operational-strategic matter.

Wellbeing at work, is a wider concept and a sum of several factors [5]. It consists of leadership, atmosphere of the work community, organizational characteristics, personal health of the employee and possibilities to influence on the work itself [9].

Organizational atmosphere focuses even more to the entirety of the organization. It can be used more as a guide to show the sector where to focus with wellbeing at work operations. Organizational atmosphere can be seen to consist of three key factors: power to do, responsibility from doing and freedom of doing [7].

3 Cash Flow Earnings Side by Side with the Profit and Loss Statement

For many companies, one of the most important priority is maximizing the affluence. The expectations of the owners may vary, but usually increasing the value of the ownings is one that every business owner share [10]. There are many ways to measure the success of the business [11], but the increase in the value of the business over time is an important way. Usually the increase in the value is accomplished by enhancing the cash flow earnings, future and present, of the company [12].

One of the most traditional financial statement is the profit and loss statement, but it does not give all those essential information's needed for the company's performance. Nonetheless the profit and loss statement can give operational results from the certain time period, from generated revenue and incurred costs point of view [13]. So basically, from profit and loss statement the basic information can be gathered, but for measuring the increase in business value, also the changes in liabilities and assets on a certain time frame need to be taken account [10, 14].

From cash flow statement can be seen and analyzed the changes of cash in certain time frame. E.g. from cash flow statement can be seen the different origins of the inflow and outflow of cash [14]. The cash flow earnings show the pure monetary value of the cash the company have in use for investments and/or financing actions like dept repayment and/or paying dividends [10].

By using the cash flow statement and cash flow earnings side by side with profit and loss statement the needed information for measuring the increase in business value can be found [10, 14].

4 Data and Procedure of the Study

Adecco Finland Oy together with Strategic Accounting Finland Oy found out, that there is an increasing interest towards wellbeing of employees and organizations. The research activities have started more and more to look also the financial side of the wellbeing, trying to bring the answers to the question why it is reasonable to invest on wellbeing in organizations. Wellbeing is an intangible investment and because of that it is not easy to measure its financial benefits. Adecco Finland Oy together with Strategic Accounting Finland Oy, wanted to find out the true monetary benefits of good organizational atmosphere. And with cash flow earnings method it could be done.

4.1 Companies Size and Fields of Business

For this study, 30 companies were selected from the fields of manufacturing, commerce and service. The financial numbers and organizational atmosphere were analyzed from the data between years 2014–2018. The turnover of the companies varies between 1,1–130 million euros and the average turnover of the company were 9,3 million euros.

4.2 Method for Distributing the Companies from Organizational Atmosphere Point of View

Those 30 companies were split into two equal categories. 15 of those had good organizational atmosphere and 15 had weak organizational atmosphere. Due to lack of coherent way to measure organizational atmosphere from power to use, responsibility from doing and freedom of doing, point of views, we needed to analyze the different kinds of data, relating to wellbeing and job satisfaction of the companies. In approximately half of the companies we had access to a wellbeing and job satisfaction reports made by external consultants. From some companies we had access to a similar kind of reports, but those were made internally. And from some companies we had only reports from employee absence and interviews from employees.

5 Results

Since autumn 2017 the movement of workforce from weak organizational atmosphere companies towards good organizational atmosphere companies has increased in Finland.

Companies with good organizational atmosphere haven't had problems to find experienced and competent workforce. These companies cash flow earnings and profit has continued to rise.

Companies with weak organizational atmosphere in the other hand, had started to struggle to find experienced and competent workforce. These companies have started to lose their market share and the cash flow earnings and profit has been falling.

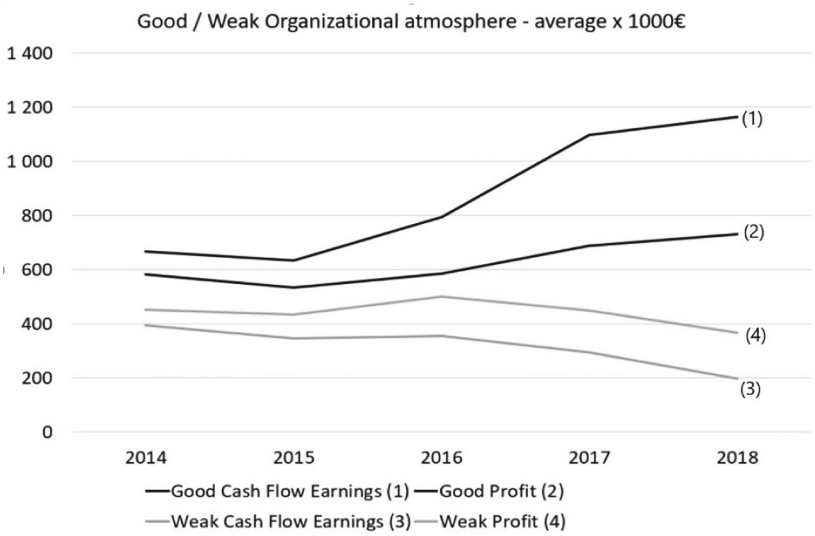

Fig. 2. Differences of the cash flow earnings and profits in the good and weak organizational atmosphere average companies.

5.1 Differences in Financial Performance of the Companies

In this study we examined changes in the companies' cash flow earnings and profit of good and weak organizational atmosphere in average company. In Fig. 2 can be seen the differences between the years 2014–2018.

As seen from Fig. 2, an average SME-company in this study, that had good organizational atmosphere, had around 900 000 euros more cash to use in year 2018 for new investments and/or dividends and dept repayment and/or for stock buybacks, than SME-company that had weak organizational atmosphere.

6 Conclusions and Future Research

This study deepens the realization that in Finland the work culture, leadership and management are in turning point. In this fast changing, hard and competitive situation the flexibility, quality and efficiency of the organizations isn't enough anymore. Ways for capability to innovate and being creative as well as organizations to harness their full potential, should be considered. It takes time to build the organizational atmosphere and results come slowly but those are long-lasting. Building better organizational atmosphere should be seen as an investment for the organization's future. Both profit and cash flow earnings keep improving slowly, but steady as long the organizational atmosphere stays good.

This study also shows a different way to measure the financial success of the organizational atmosphere and wellbeing investments. Article also summarizes few points, why the cash flow earnings method should be used side by side with the profit and loss statement.

Future research should focus on building a coherent way to measure organizational atmosphere. Also, more research for using cash flow earnings side by side with the profit and loss statement is needed. Research to deepen the financial effects, especially cash flow earnings, of improving organizational atmosphere and wellbeing of the employees should also be focused.

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References

1. Alasoini, T.: Mainettaan parempi työ. Finnish Business and Policy Forum EVA, Helsinki (2010). ISBN 978-951-628-508-8
2. Schwab, K.: The Fourth Industrial Revolution. World Economic Forum. Geneva, Switzerland (2016). ISBN 978-1944835002
3. Goleman, D.: Working with Emotional Intelligence. Bloomsbury Publishing PLC, London (1998). ISBN 978-0747539841
4. Goleman, D.: Focus The Hidden Driver of Excellence. Bloomsbury Publishing PLC, London (2013). ISBN 978-1408850565
5. Penttinen, M., Reunanen, T.: Organizational Performance from Wellbeing and Enthusiasm – Conceptual Model for Leaders, pp. 54 – 63. Book of scientific papers: Business Intelligence as a Tool for Knowledge Development in Business Organizations, Bratislava (2016)
6. Mulford, C., Comiskey, E.: Creative Cash Flow Reporting: Uncovering Sustainable Financial Performance, pp. 78–79. John Wiley, Hoboken (2005)
7. Julmi, C.: Organizational atmosphere: the missing link between organizational culture and climate. Int. J. Work Organ. Emot. **8**(2), 131–147 (2017). Inderscience Publishers, Genèva, Switzerland
8. IAET: European Union terminology: Commission Staff working document, Employment in Europe 2010 Report. European Union (2010)
9. Manka, M.-L., Kaikkonen, M.-L., Nuutinen, S.: Hyvinvointia työyhteisöön – eväitä kehittämistyön avuksi Tutkimus- ja koulutuskeskus Synergos. Tampere University, The European Social Fund, Tampere (2007). ISBN 978-951-44-7237-4
10. Raitala, L.: How to Improve Cashflow Management in the Case Company. Turku University of Applied Sciences, Turku (2020)
11. Jury, T.: Cash Flow Analysis and Forecasting: The Definitive Guide to Understanding and Using Published Cash Flow Data, p. 4. John Wiley, Hoboken (2012)
12. Koski, T.: Pk-yrityksen strateginen talousjohtaminen. 2. painos, pp. 71. Kauppakamari, Helsinki, Finland (2017). ISBN 978-9522464859
13. Ramagopal, C.: Accounting for Managers, p. 178. New Age International Ltd., Delhi (2009)
14. Arora, M.N.: Management Accounting: Theory, pp. 75–77. Problems and Solutions. Himalaya Publishing House, Mumbai (2009)

B2B Marketing Method Adapted to Sales Improvement Through the Implementation of ABC Classification Tool and Inbound Marketing in SMEs

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Abstract. It has been found that the main causes of insufficient sales of different small and medium-sized enterprises (SMEs) is the low conversion rate of quotes into sales, which entails poor business performance and low economic impact. Therefore, a marketing methodology called inbound marketing is planned, which is modified and adapted to the case study. In contrast, tools such as ABC classification, workflow, and inbound marketing have been used as a structure of the proposed methodology to solve the problem. The implementation of this methodology resulted in an increased efficiency of quote development and an enhanced performance ratio thereof. In conclusion, it is possible to measure the financial impact of the methodology implementation which has been beneficial for the company under study. Business performance in the last month of implementation improved by 10%.

Keywords: Time management · Quote · Sales · Inventory · ABC classification · Workflow · Sales funnel · B2B marketing · Inbound marketing

1 Introduction

The global economy is showing a clear trend toward business and market internationalization. SMEs play a key role in this process, because they are the organizations most capable of adapting to technological changes and generating employment. In the European community, SMEs account for more than 95% of all enterprises in the OECD countries, providing over two thirds of the total employment: approximately 60% in the industrial sector and over 75% in the service sector. In Peru, the SME sector is very

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important to the national industrial structure in terms of its contribution to national production (42%), according to the Small and Micro-Enterprise Promotion Commission (PROMPYME).

The SME sector is one of the most important economic sectors in Peru, because it accounts for 96.5% of the Peruvian enterprises employing over 8 million Peruvians. One of the challenges that most business-to-business (B2B) companies face is the time the sales department takes to respond to customer e-mails, given that today's customers expect instant responses to the requested information. With respect to the millennial generation becoming more powerful in the market, 66% of millennial consumers expect real-time answers and interactions compared to the only 62% of baby boomers and traditionalists. The studies conducted in some Mexican hotels in 2018 revealed a 6.9% increase in the number of domestic tourists compared to the previous year and a 2.5% increase in the number of international tourists over the previous year and showed quotes of services presented. However, 67% of them did not send the quote and 73% did not qualify the prospect, this is precisely where the problem to be addressed in companies is found.

Given the importance of rapid response customer service in SMEs, research has focused on using tools and models that generate an efficient conversion of quotes to sales. This is due to the fact that 61% of buyers decide to change suppliers when they perceive a lack of interest on the part of the company that is serving them. Furthermore, if the new supplier is professional and responds promptly, they are quite likely to win over the customer (3 to 5 times out of 10 opportunities).

2 State of the Art

2.1 B2B Model in Marketing Companies

The B2B marketing model is considered a company strategy that allows companies to collect potential customer's information. In summary, the authors agree on the benefits provided to customers, such as the implementation of messenger chatbots to effectively find information about the main product and make the purchase [1, 2].

2.2 ABC Classification in Companies with Recurring Demand

Therefore, the authors mentioned focus on demand for products, as well as on locating product batches since processes and items are requested according to the demand. Likewise, they agree on the importance of demand performance and knowing the right supplier for the product. It is also important to assess the waiting time and product collection by the company and make a good distribution and control thereof [3–6].

2.3 Inbound in Product Marketing Companies

The similarity between these articles lies in the fact that the authors conceptualize the methods to reach the customer and assess employee behavior. In addition, they focus on certain categories of advertising [7, 8].

2.4 Inbound Marketing Component and ABC Classification and Companies

Therefore, companies should focus on customers, starting from typologies and processes, in order to increase sales and customer portfolio. In addition, it is important to provide information when introducing the business to new subscribers, in terms of reception of products and services provided and advertising to present a price range with respect to consumer selection [9, 10].

3 Contribution

3.1 Rationale

On the one hand, the technique that will be implemented for the model is inbound marketing to ensure advertising and thus increase store sales [11].

Additionally, the ABC classification will be used, where companies strive to implement an effective purchasing strategy (improving inventory turnover). The results of this study are expected to help researchers improve their decision-making in order to better understand the impact of strategic purchasing advances on variance and complexity management. Secondly, the article "Un retraso de dos niveles en el contrato pagos para la coordinación cadena de suministros: el caso de la demanda de crédito dependiente" (A two-level delay in payments contract for supply chain coordination: The case of credit-dependent demand) shows the importance of this tool in the last phase of customer loyalty, since companies intend to delight customers with quick attention and obtain the stock needed for the offers strategically analyzed by the ABC classification [5].

On the other hand, in SMEs, the relationship between the company and the customer is also important, because sales managers and account executives in companies do not differ from the rest of the sales force in terms of their attitude toward relationship management. Thus, a tool was developed aimed at exploring the full scope of a service sector sales force through the different sales and relationship management roles [9].

3.2 Proposed Model

In accordance with the above, the B2B marketing model adapted to sales improvement is implemented through an ABC classification and inbound tool in an SME and is divided into levels as mentioned by the authors [2] and [12] in order to solve the issue of inadequate management of the quote-to-sale conversion, because it considerably impacts the company under study.

This model comprises the following components (Fig. 1):

- Research phase
- Attracting phase
- Conversion phase
- Closing phase
- Delight phase

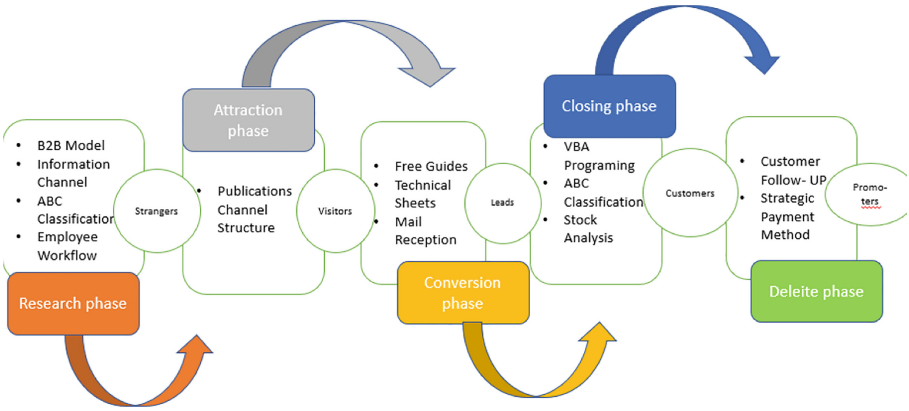

Fig. 1. Proposed model

3.3 Detailed View

B2B Model

- Purpose: To strategically attract the target customer, i.e., the companies in this case
- Represents: It is the model phase where related and anticipated content that contributes added value is generated
- Interprets: In this model, strategic activities such as publications, mailings, and technical sheets are used in accordance with the potential customer.

VBA Programming

- Purpose: To automatically generate customized reports and perform other data processing functions
- Represents: This component is found in the closing phase, i.e., the quote development.
- Interprets: It is one of the most essential model components, as it focuses on the improvement of the general problem of the case study.

ABC Classification

- Purpose: To segment warehouse product references according to their importance in three categories (A, B, C)
- Represents: This component is found in two phases, research and closing, in which the products most requested by customers are analyzed.
- Interprets: This technique will be used to publish strategic content in the sales channel. In addition, it will be supplemented by stock analysis activities for customer service.

Customer Follow-Up

- Purpose: To delight new customers so that they can be integrated into the customer portfolio
- Represents: This component is found in the last phase, delight, and will monitor if the customer is satisfied with the product and service provided.
- Interprets: Digital tools such as e-mail and apps will be used to have a closer relationship with the customer in addition to providing a personalized service.

4 Validation

The study was carried out at SEI PERU, a tool supply company.

Describe the Scenario. The problem presented by the company under study is the low conversion rate of quotes into sales. One of the main reasons why the customer chooses not to send the purchase order is the ineffective quote development. This table shows the ranges of hours when the quotes were developed from July 2018 to July 2019.

Describe Initial Diagnostic Values

Indicators	Formula
Loyalty	$\frac{45-40}{45} \times 100\% = 11\%$
Quote efficiency	$\frac{12}{36} \times 100\% = 33.3\%$
Quote performance	$\frac{5670.70}{20535.19} \times 100\% = 29\%$
Increased sales	$\left(\frac{28540-20535}{28540}\right) \times 100\% = 28\%$
A-Product usefulness	60%
Conversion rate	$\left(\frac{204}{731}\right) \times 100 = 28\%$

Development of the Proposed Model

- Market Research Phase

B2B model
Through the analysis of the company's customer's portfolio, we identified the customer's profile. In addition, we presented key proposals for the type of customers, as follows:

– Sales channel selection according to the customer profile, Web page
– An active and continuous presence through the website

Channel structures
In addition, the website part is structured, updating publications, editing images, and adding descriptions among others.

- Conversion Phase

Strategic items:
At this stage, the decision is made to immediately send the product data sheets along with the requested quote. In addition, these sheets are expected to be automatically added in the publications on the same website. Next, a product characteristics sheet is presented.
E-mail reception:
We are implementing the practice of responding to emails immediately once the quote has been received. The virtual catalogues and the company's presentation are shown in this welcome e-mail.

- Closing Phase

VBA programming
In this phase, VBA macro programming is used to speed up quote development. The codes used for this process are shown below.
ABC classification
In this phase, the ABC classification is used to inform the customer about the product delivery time. In addition, this analysis will be used to improve inventory turnover.

- Delight Phase

Follow-up
The strategic follow-up plan is being implemented in the sales department. The activities to be carried out to obtain an adequate customer follow-up are shown below.

– Send a customer satisfaction survey.
– Propose offers according to the volume required by the customer.
– Send clearance sale catalogues to arouse interest.

Method of payment
At the quote time, the credit corresponding to each customer is indicated. In addition, the seller specifies the method of payment to the customer. This added value, which is the credit offered, must be less than the credit the company has with its suppliers.

5 Results

Indicators	Formula
Loyalty	$\frac{58-45}{58} \times 100\% = 22\%$
Quote efficiency	$\frac{16}{43} \times 100\% = 37.2\%$
Quote performance	$\frac{17997.37}{46217.21} \times 100\% = 39\%$
Increased sales	$\left(\frac{46217.21-28540}{46217.21}\right) \times 100\% = 38\%$
A-Product usefulness	60%
Conversion rate	$\left(\frac{260}{850}\right) \times 100 = 30.4\%$

6 Conclusions

The conclusions are as follows:

- The customer portfolio grew by 22% between September and October.
- Quote efficiency increased to 37.2%.
- Quotes in relation to sales went up by 39%.
- Sales grew by 38% in the last few months.
- The profit margin of the products will be diversified by 60%.

References

1. Agnihotri, R., Dingus, R.: Social media: influencing customer satisfaction in B2B sales. Ind. Mark. Manag. 1–9 (2015)
2. Bahrami, B., Aghezzaf, E.-H., Limère, V.: Enhancing the order picking process through a new storage assignment strategy in forward reserve. Int. J. Prod. Res., 1–23 (2019)
3. Frandsen, C.S., Nielsen, M.M., Chaudhuri, A.: In search for classification and selection of spare parts suitable for additive manufacturing: a literature review. Int. J. Prod. Res., 1–28 (2019)
4. Heydari, J., Rastegar, M., Glock, C.H.: A two-level delay in payments contract for supply chain coordination: the case of credit-dependent demand. Int. J. Prod. Econ., 1–39 (2017)
5. Järvinen, J., Taiminen, H.: Harnessing marketing automation for B2B content marketing. Ind. Mark. Manag. **164**(1–12) (2015)
6. Balcazar, C., Chavez, C., Viacava, G., et al.: On-demand warehousing model for open space event development services: a case study in Lima, Peru. Advances in Intelligent Systems and Computing, vol. 1026, pp. 953–959 (2020). https://doi.org/10.1007/978-3-030-27928-8_143
7. Kis, Y., Chyrun, L., Tsymbaliak, T.: Development of system for managers relationship management with customers, pp. 1–17. Springer Nature Switzerland (2020)
8. Kwiatek, P., Thanasi-Boçe, M.: Loyalty program activity: make B2B customers buy more. Mark. Intell. Plan., 1–14 (2018)
9. Weitzl, W.J., Hutzinger, C.: Increase and fall in claimants' wishes: the role of the brand. J. Acad. Mark. Sci., 35–47 (2019)
10. Heydari, J., Rastegar, M., Glock, C.H.: A two level delay in the contract payments for supply chain coordination: the case of the dependent credit. J. Acad. Mark. Sci., 32–43 (2019)
11. Vieira, V.A., Almeida, M.I., Agnihotri, R., Silva, N.S.: In pursuit of an effective B2B digital marketing strategy in an emerging market. J. Acad. Mark. Sci., 1–24 (2019)
12. Agnihotri, R., Dingus, R., Hu, M.Y., Krush, M.T.: Social media: influence of customer satisfaction on B2B sales. Mark. Intell. Plan., 50–62 (2015)

Sales Process Evolution

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Abstract. As the sales has evolved from feature-based selling into value creating interaction, so has the sales process evolved with the development of understanding and technology. When traditional sales saw a sales process to be like a funnel running from lead generation via sales meetings and negotiations to deals, in today´s value sales process sales does not end to sales contract or even after sales. Feature-need-benefit-value framework is combined with characteristics and the competitive advantages of traditional, service, expert and value sales processes.

Keywords: Sales · Sales process · Expert sales · Value sales · Value

1 Introduction

Sales has existed as long as interactions between people have existed, but the way sales is performed has transformed with the development of understanding and technology. Traditional sales interaction consisted of active seller who presented features of the sold products in one-way communication to a passive customer. When the importance of the services rose, the one-way communication transformed into equal discussion and the role of customer changed to be an active participant who interacts with active seller, who behaves like questioner trying to identify the customer needs [1].

In modern solution sales, seller acts as problem solver who tries to define the benefits of their solution together with active professional customer by utilizing sales techniques like situation-problem-implication-Need/pay-off (SPIN) questions. Today, the customer knowledge of the needed product or service is high, changing the sales interaction to value co-creation, regardless of type of interaction method or technology. Both seller and customer act as co-creators of value, when both customers and sellers offer and receive value, also by interaction itself, by relationships or even by the interaction method [1].

2 Sales Processes

As the nature of sales has evolved, so has the sales process. When traditional sales saw a sales process to be like a process running from lead generation via sales meetings and

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negotiations to deals and implementation [2], in today´s sales process sales do not end to sales contract or even after sales.

With the transformation from traditional feature-based sales with one way communication, to today's sales where seller and customer are value co-creators, the competitive advantage of seller has also evolved. In traditional sales process, product features and product knowledge of the seller gave the competitive advantage, whereas in value sales process competitive advantage has evolved for value creation (Table 1).

Table 1. Seller's competitive advantage in different sales processes.

Sales process	Seller competitive advantage
Traditional	Product features and knowledge
Service	Service excellence and quality
Expert	Problem solving and solution
Value	Value creation

2.1 Traditional Sales Process

In traditional sales the role of marketing is to lead, meaning that marketing and sales are separated processes and that marketing generates the possibility for the sale by generating the interest on a potential customer [2], like in business-to consumer markets. In traditional sales, the role of the seller is active speaker, who charms the passive customer by providing superior product feature information. Traditional sales approach always requires a physical portion of sales interaction to be present. Nowadays, also digital elements can exist, but the sales takes place between two individuals. Traditional sales products are often tangible products or parts of tangible products, like cell phones or their connections.

As seen in Fig. 1, sales process starts with lead identification. The process is normally followed by meeting the customer, making an offer and with positive sales negotiation, closing the deal. When utilizing traditional sales process, it is noteworthy that normally the amount of leads is high. The competitive advantage is highly linked with product features/knowledge and seller's ability to sell them.

2.2 Service Sales Process

The products following service sales process can be pure services or products combined with service element. Although the role of marketing is enabling and it is much needed to ensure sales, it is still seen as very separate as sales, having its own approaches. Successful sales process management with good references are the best marketing tool, increasing the seller company's credibility and ability to produce similar services to other customers.

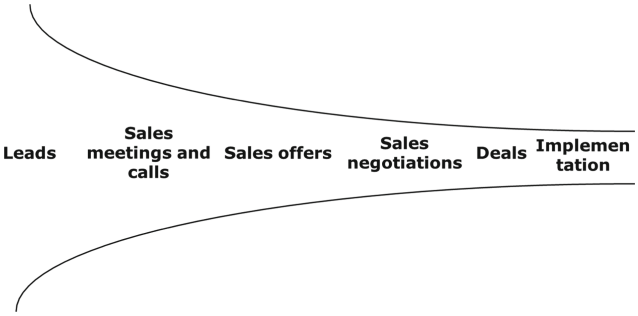

Fig. 1. Traditional Sales process [2]

The role of the seller can be seen more as active questioner who has an active discussion with the customer. The sale is based on the need of the customer, which the seller tries to find out with equal discussion. Typically, the knowledge level of the seller is high, and the knowledge level of the customer is on advanced level, meaning they have some knowledge on the product, but not very detailed. This depends on the quality of the service and its complexity, as well as the industry for which the service is produced.

Service sales can be considered as heavily service dominant businesses, both in business-to consumer (b-to-c) and business to business (b-to-b) environments, like consultancy or travel agent businesses. The amount of physical interaction is still high, although some elements of social media do exist. The effect of social media is greater in b-to-c sales where an individual's values and preferences matter more, as it involves a personal purchase decision, which reflects a person's lifestyle and values. In b-to-b sales, decision-making is more significantly influenced by references of the service, provided by the seller company.

In Fig. 2, sales process starts with prospecting and goes through a similar process as in traditional sales, but it is not finished with the implementation. Follow up activities, like delivery of the service, customer satisfaction or additional sales are part of the follow up and the process. In service sales process, the number of prospects is normally less than in traditional sales process and takes into account the redefinition of leads into customers [2].

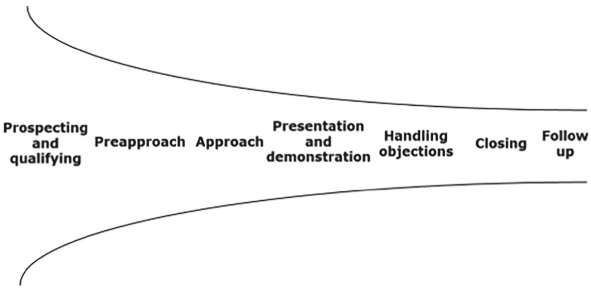

Fig. 2. Example of service sales process [3]

In service sales process, the amount of time spent in different stages of the process is typically higher than in traditional sales process, due to the amount of people involved and due to the complexity of the service and decision-making. Typically, the offer is often updated during the process, generating possibilities for additional sales.

The competitive advantage of service sales process is the service excellence and quality and requires the seller's strong commitment to the customer's project as well as quality requirements in order for the result to match the customer's expectations [4].

2.3 Expert Sales Process

In the expert sales process, the role of the marketing is demising, especially due to the nature that it is applied mainly on business to business environment and especially in technical sales. In the expert sales, the role of the seller transforms to be an active problem solver, who tries to identify the real problem of the customer by utilizing active questioning techniques like SPIN questions to translate the need of the customer to a benefit the seller's product/service/solution can offer to solve the problem. The customer is normally an active professional, who has a good understanding of available products, service providers and the need that they think they have.

The solution sales can be seen with tangible products or services, but most commonly with the combination of them. As seen in Fig. 3 expert sales process starts with identification of need and potential solutions. The contacting can be done by the seller or customer by using various ways. Definition of the problem, need or desired benefit is conducted as the technical sales offer customization is performed. This can take several rounds in the form of meetings and communications making the process less linear, but possibly taking several cycles. While the technical sales offer customization is done, the tradeable negotiation takes place, potentially changing the offer and making the closing the deal to be a lengthy process.

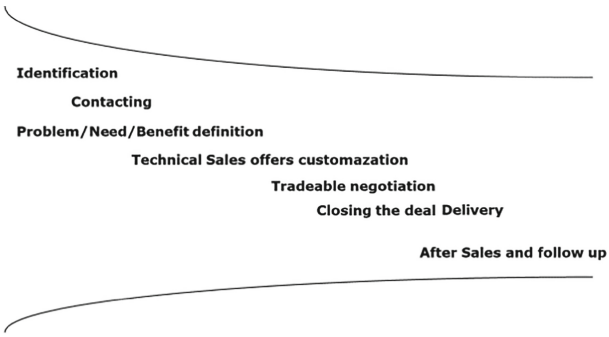

Fig. 3. Expert Sales process, adapted from [5–7]

The amount of time spent during the expert sales process continues to increase due to the amount of people involved, complexity of the offered solution and the defined items of the offer (tradeable). In the expert sales process the delivery time span can be long and very often after sales activities, such as additional sales of additional products,

services and solutions happen while the delivery is ongoing, raising the importance of the follow up.

The follow up often has service or support element, making the activities after closing the deal biggest marketing advantage and enabler for additional sales [5]. Marketing in traditional sense has much lesser importance than the reputation of the company. Seller's competitive advantage comes from ability to solve problems and provide solutions.

2.4 Value Sales Process

In value sales process, marketing is blending to the value sales process. Similar evolution can be seen in pure marketing, where all marketing is starting to resemble to a greater degree the formerly specialized area of service marketing [8].

In value sales, the customer knowledge is normally high and their role, as well as seller's role changes to be more value co-creators. The digital element is usually present during all the stages of value sales changing the sales to be more a customer experience than sales process.

The Steps of the value sales process are awareness, discovery, evaluation, conversion purchase and commitment as seen in Fig. 4. and the stages of need identification, benefit evaluation, sales and co-created value are parts of the value sales process.

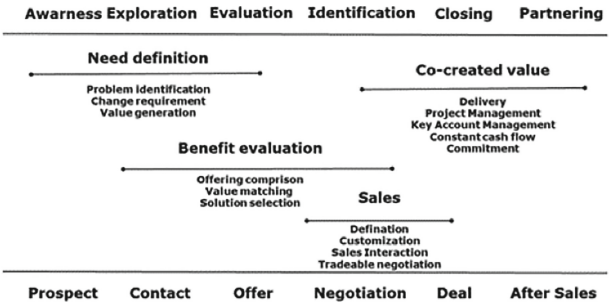

Fig. 4. Value sales process

In traditional sales processes, the steps can be seen as process parts which follow each other and lead to closing the deal, while in value sales process focus is transferred to creating long lasting customer experience and seller-customer value co-creation which is evaluated by all stakeholders [9] and seller, customer and mutual perspective [10]. Products and services form a structure around which individual experiences can be created together, including in business to business sales process [11].

3 Conclusions

All sales products have features, which define the characteristics of the offered product, service, technical solution or value adding element. While the traditional sales focused on selling features mainly focusing on the selling company´s own advantages, sales have

evolved to take into account the customer and their needs. From the customers' needs, finding solutions by utilizing the competences of expert sales, solutions proving benefits can be formed. All this is done to create value for both the seller and customer (Fig. 5).

Fig. 5. Feature-need-benefit-value framework

Value can be seen as value, which is embedded to products and services, value propositions for the companies themselves or the other stakeholders, co-created value propositions with suppliers and customers, value creation created by participants of shared negotiations and co-created value created by collaboration and achieved customer solutions [12].

All presented sales processes do still exist and they depend heavily from the industry, type of the sales and culture. Due to the increased awareness and advancement of technology, the elements of value sales process can be seen in all sales processes, ranging from traditional feature-based sales to values based sales. Connection to buying process is very logical next field of study.

References

1. Hänti, S., Kairisto-Mertanen, L., Kock, H.: Oivaltava myyntityö. Edita Publishing Oy, Helsinki (2016)
2. Tanner, J.F., Honeycutt, E.D., Erffmeyer, R.C.: Sales Management, Shaping Future Sales Leaders. Pearson Education Limited, Essex (2014)
3. Kotler, P., Armstrong, G.: Principles of Marketing, 10th edn. Pearson, Prentice Hall, Upper Saddle River (2004)
4. Heskett, J.L., Sasser Jr., W.E., Hart, C.W.L.: Service Breakthroughs, Changing the Rules of the Game. The Free Press, New York (1190)
5. Winkelmann, P.: Vertriebskonzeption und Vertriebssteuerung, 5th edn. Vahlen (2012)
6. Care, J., Bohlig, A.: Mastering Technical Sales, 3rd edn. Artech House, Boston (2014)
7. Holopainen, T., Röhr, T., Tómasson, M., Murzin, M., Ben-Amor, M.: Sales competition as education method – the case of the European sales engineering team competition. In: Kantola, J., Nazir, S., Barath, T. (eds.) Advances in Human Factors, Business Management and Society. AHFE 2018. Advances in Intelligent Systems and Computing, vol. 783. Springer, Cham (2019)
8. Rust, R.T., Huang, M.-H.: The service revolution and the transformation of marketing science. Mark. Sci. **33**(2), 206–221 (2014)
9. Töytäri, P., Rajala, R.: Value based selling: An organizational capability perspective. Ind. Mark. Manag. **45**, 101–112 (2015)
10. Terho, H., Haas, A., Eggert, A., Ulaga, W.: 'It's almost like taking the sales out of selling' – towards a conceptualization of value-based selling in business markets. Ind. Mark. Manag. **41**, 174–185 (2012)
11. Prahalad C.K., Ramaswamy, V.: The Future of Competition: Co-creating Unique Value With Customers
12. Ballantyne, D., Varey, R.J.: Creating value-in-use through marketing interaction; the exchange logic of relating, communicating and knowing. Mark. Theory **6**, 335–348 (2006)

The Dividers for Continuum of Business in Business Transfer Situations and Impacts to Cash Flow Earnings: A Study from SME-Companies in Finland

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Abstract. The well-functioning markets of business transfers can bring competitive advantage regionally and nationally. At the same time, management and leadership culture in transferred companies are in crucial role for the success or failure of the transferring situations. Valuing business transferring and the organizational success of transfers from the profit and loss statement or return of assets or investment point of view, can raise challenges.

This article reveals a different way for valuing business transferring and organizational success of transfer. A cash flow earnings-based method that can take into account the changes happening in different kinds of processes. Through this study there is also brought up some of those factors that have huge impact on the success of transfers. The future research actions and needs are handled and addressed in the end of the article.

Keywords: Cash flow earnings · Business transferring · Leadership · Management · Business development · Measuring performance

1 Introduction

In recent years the understanding towards importance of business transfers for enhancing growth and development of the businesses has increased. In the past, when looking at

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business transfers, the aging of the entrepreneurs has been central. Recently in addition to the aging entrepreneurs that sell their businesses, there is also an increasing number of transfers between younger buyers and sellers. The reason behind this is that businesses transferring is coming an increasingly important part of the natural strategic development and growth of small businesses. Due to the changes happening in entrepreneurs, companies and business environments, the role of business transfers as a development tool at different stages of the business life cycle, seems to be increasing [1, 2].

Markets of business transferring, that includes also SME-companies, have a chance to benefit many, not only to those that are directly affected by transferring. The benefits consist from many different components. Business transferring situations should be handled without losing accumulated know-how and assets of the employees and surroundings. Successful transfer of ownership and business means that the entrepreneurs who are stepping down are rewarded from their work, knowledge and customer relationships are not wasted, networks and regional vitality are not compromised, and jobs and tax revenues are not lost [2, 3].

According to surveys conducted by the Confederation of Finnish Industries EK, number of companies in a transfer situation has remained quite high, roughly unchanged over the past years. Around 16,000 companies are currently in a situation of transferring the ownership and this affects around 80,000 employees [1]. Buying a company is more often the way to become an entrepreneur, ending the career as an entrepreneur involves more often selling the company and developing the business involves more often buying or selling a company or business activity [2].

2 Business Transferring Situations

Business transferring means the situation where the business activity or the whole company is transferred to a new owner. The new owner can be a family member, other relative or someone outside the family. Business transferring as a term is used especially in cases where the new owner comes inside the family and the generation in company's ownership changes [3]. Business transferring situation is usually a very complicated process, from financial and mental point of view. From the buyer or seller point of view, the most important thing is that the company and its operations will stay healthy after the business transferring situation [4].

Because the process for the business transferring is so complicated, it is important to start the planning early enough. In Finland average time for business transferring situations is 3–5 years [5]. Key for successful business transfer is well executed planning of the whole transfer situation [3].

3 What is Cash Flow Earnings?

The cash flow earnings are very important to the financial health and performance of the company. Because from profit and loss statement can't be told whether the company has cash or not [6]. The cash flow is clearly stated to be used for stock buybacks, new investments, dividends and dept repayment [7]. For the bottom-line profit, there isn't a clear statement.

Companies incoming and outgoing monetary actions are called cash flow earnings. Concept of cash flow earnings encase transactions towards cash register, payments from the purchases and incomes from sales flows, to name a few. Cash flow earnings statement and the traditional profit and loss statement are like mirror images. The true difference between these two is that the cash flow earnings statement measures with only one indicator the performance of the business output, and that indicator is concrete money. Cash flow earnings statement is only concerned about the increasing or decreasing of cash balance in a certain time frame. Due to that reason the cash flow earnings can reflect the performance of businesses output in a pure and more understandable way [8].

3.1 Why Cash Flow Earnings – Method is Good for Measuring Performance and Success of the Business

Long term finance planning takes a substantial amount of time in every organization. Still the raising challenge among organizations is to find the answers how to survive from short term financial challenges. Many times, the assumption is that when e.g. a company sells goods or provides services it creates cashflow. This assumption also needs to take account the fact that the company need to pay for the personnel salary that perform the provided services or pay from the goods they are selling with some margin [8].

Organizations most important and significant asset is cash. It is needed to cover the expenses of every day-today actions, paying the employees' wages and purchasing raw materials, to name a few. Growing or developing the business also needs cash, and the cash is needed right on that specific time [9, 10]. Basically without cash it is hard to run a business.

4 The Study: Methods and Data

The Regional Federation of Finnish Enterprises in Southwest Finland together with Strategic Accounting Finland Oy found out that even there is an increasing interest towards business transferring situations, there hasn't been done much research from the financial success of these situations. Also, the reasons for the financial success of the transferring is less known.

Purpose of this study was to find out those factors mentioned earlier. What makes the difference between successful and unsuccessful business transferring situation and is there a clear financial difference from the cash flow earnings point of view.

4.1 Size and Fields of the Companies

The business transferring situations happened between years 2000 and 2015. For this study 20 companies were selected from service, commerce and manufacturing industries. The turnover of the companies varies between 0,5–5 million euros and the average turnover was 1,8 million euros.

4.2 Methods for Dividing the Companies from Leadership and Management Culture Point of View

The 20 companies were split into two equal categories. 10 of those that were managed by horizontal ways and 10 that were managed by vertical ways.

In the Table 1 below, the findings from horizontal way of managing can be seen.

Table 1. Findings from horizontal way of managing.

Horizontal way of managing:	The power to make decisions is distributed to employees
	People have started to carry their responsibilities
	The term benefits of relative know-how is well known
	There is a culture of trust between employees and employer
	The organizational hierarchies are low
	Expenses from administration and management are low
	Replacement among employees is low
	Recompensing to support fast decision making is a part of the managing system

In the Table 2 below, the findings from vertical way of managing can be seen.

Table 2. Findings from vertical way of managing.

Vertical way of managing:	The power for decision making is held strictly in the hands of the owner
	The term benefits of relative know-how is hardly known
	Culture of trust between employees and employer doesn't exist
	High number of middle managers
	Authoritative management
	Expenses from administration and management are high
	Signs from the culture of silence
	High replacement among employees

Behind these two different ways of managing is the two organizational structures, vertical and horizontal. The idea of horizontal organization is to give the structural form for organization for it to be able to deliver the maximum value for its customers [11].

4.3 Different Ways to Transfer Business

Below in Table 3 are listed five different situations for transferring the business, that found out during the study. In all these situations the entrepreneurs were a bit older and

had already started to think their retirement days. Also, there is brought up few examples what it means in each situation.

Table 3. Different ways to transfer business

Retirement:	The retiring entrepreneurs are in good physical and mental health
	The companies were in good financial condition, even the retirement arrangement had strained accumulation of the equity
Selling:	Safety for retirement days is based for the hope to get the business sold. Sometimes it succeeded, but not always
	Often the entrepreneurs who are stepping down, are already tired and their focus is already in the retirement days
	There are also few examples that in these kinds of situations also the companies were not in a very good financial condition
Generational change:	Usually the change happens in the ownership and top management of the company
	Often the new owners come from the family, vicinity or company's key persons
	If the owners who are stepping down, don't have the patience to let go from their life work, the companies don't have high chances to develop and grow
Generational multiplying:	Part or entirety of the ownership will change
	Owner who is stepping down continues in advisor's role sharing the gathered know-how and experience
Leader change:	The ownership of the company stays in the hands of the entrepreneur
	Bearers of the responsibilities and the users of power changes
	Many times, if the owner isn't patience enough not to use the power that the owner has, the chances for company to develop and grow aren't very high

5 Results

The actual value, cash flow earning performance, on the companies managed by modern, horizontal way, were higher than the owner who is stepping down had calculated. Companies managed with traditional vertical way, the actual value, cash flow earning performance, were lower than the stepping down owner had calculated.

5.1 Difference in Cash Flow Earnings

In this study we examined the changes in the companies' financial performance from 4 different points of view. In Fig. 1 can be seen the difference of the cash flow earnings

and profit in horizontal and vertical way managed average companies between the two years before the business transferring and two years after the transferring.

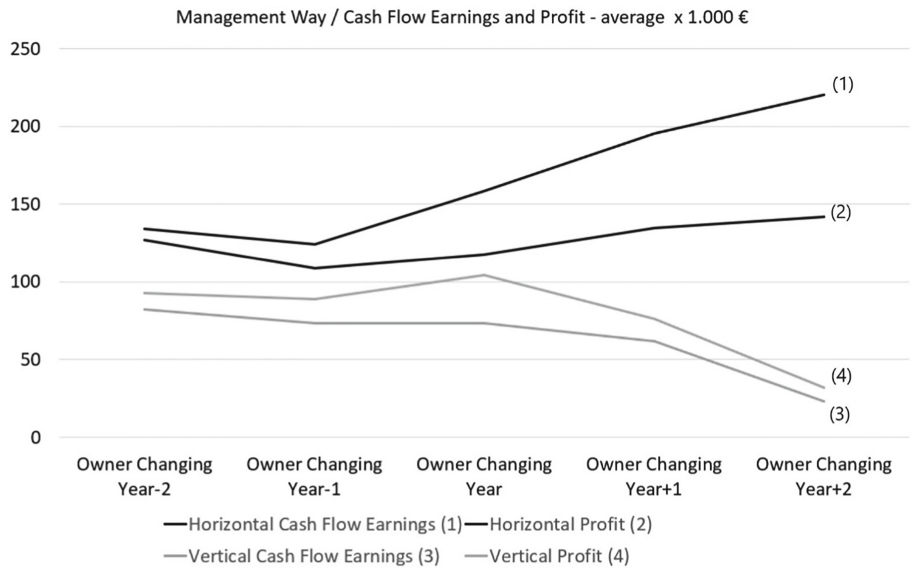

Fig. 1. Differences in cash flow earnings and profits in horizontally and vertically managed average companies.

In Fig. 1 can be seen that, after two years from business transferring, an average SME-company in this study, that were horizontal way managed, had around 200 000 euros more cash to use for new investments and/or dividends and dept repayment and/or for stock buybacks, than SME-company that was managed by vertical way.

Also, an estimation for a five-year income value for cash flow earnings were calculated. For that we used the average cash flow earnings numbers, one year after the owner changing situation. Multiplying the number by five and discounting it with 0% interest.

In average company, managed by horizontal way, the estimation for a five-year income value for cash flow earnings were 670 000 euros more than in the vertically managed average company. More cash to be used for new investments and/or dividends and dept repayment and/or for stock buybacks.

6 Conclusions and Future Research

The results of this study deepen the general assumption of the negative impacts of SME-companies personifying to the owner. In the other hand, the study reinforces the results of other research, that the business transferring situations are almost without exceptions a starting point for new kind of growth. The study also raises up several new ideas that are good to notice when planning business transferring situations, either from the view of buyer or seller. The study also shows a different kind of method to measure up the

actual value of the company, the cash flow earnings method and summaries few of those points, why the cash flow earnings method is good way to measure performance.

Future research should focus on building an ontology for cash flow earnings method. Also, research if the cash flow earnings method is usable in different kinds of case studies is needed. Research to deepen the reasons for successful business transferring should be continued and also how to connect the cash flow earnings for a longer period in those transferring situations to measure the true effects of decisions and functions to the concrete cash value should be focused.

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References

1. Huovinen, J.: PK-Pulssi: EK:n yrityskyselyn tulokset. Confederation of Finnish Industries EK, Helsinki, Finland (2017)
2. Viljamaa, A., Tall, J., Varamäki, E., Singer, S., Durst, S.: Business Transfer Ecosystems and Awareness Raising Activities: Situation Analysis of Five European Countries. Publications of Seinäjoki University of Applied Sciences B. Reports 108, Seinäjoki, Finland (2015). ISBN 978-952-7109-33-5
3. Immonen, R., Lindgren, J.: Onnistunut sukupolvenvaihdos, pp. 14–18. Talentum Media Oy, Helsinki, Finland (2006)
4. Suokas, L.: Case-yrityksen sukupolvenvaihdos ja yhtiöittäminen. Saimaa University of Applied Sciences, Lappeenranta, Finland (2015)
5. Stenholm, P.: Yrityksen sukupolvenvaihdos ja sen tukeminen, pp. 47–49. Edita Publishing Oy, Helsinki, Finland (2003)
6. Epstein, L.: The Business Owner's Guide to Reading and Understanding Financial Statements: How to Budget, Forecast, and Monitor Cash Flow for Better Decision Making, pp. 72–73. Wiley, Hoboken (2012)
7. Mulford, C., Comiskey, E.: Creative Cash Flow Reporting: Uncovering Sustainable Financial Performance, pp. 78–79. Wiley, Hoboken (2005)
8. Raitala, L.: How to improve cashflow management in the case company. Turku University of Applied Sciences, Turku, Finland (2020)
9. Ramagopal, C.: Accounting for Managers, p. 178. New Age International Ltd., Delhi (2009)
10. Satyaprasad, B., Raghu, G.: Advanced Financial Management, pp. 89–92. Global Media, Mumbai, India (2009)
11. Ostroff, F.: The Horizontal Organization: What the Organization of the Future Actually Looks Like and How it Delivers Value to Customers. Oxford University Press, Inc., New York (1999)

Factors Affecting the Behavior of Financial Markets in the Light of Financial Risks

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Abstract. The financial market is the primary source of financing, which institutions need to finance their projects as well as their own potential to achieve their financial and material resources.

The presence of financial markets in any country reflects the development of the economies of countries and their progress. It aims to secure the flow and pool savings to contribute to the investment and development process by mobilizing and directing financial resources, facilitating trading, diversifying risks and increasing investments.

The development of financial markets linked to the economic development experienced by most countries of the world because of their role in stimulating investment.

So, the financial market influenced by the results of past events to anticipate future events in an economic environment characterized by instability and uncertainty due to the possibility of facing financial risks.

Keywords: Financial market · Financial risk · Risk management · Financial liberalization · Interdependence · Instability economic

1 Introduction

The development of financial markets has been associated with the economic development experienced by most countries of the world. Given the role of capital markets in stimulating investment, we are exposed to the most important characteristics of these markets, and the pillars underlying them by defining them, their development, their importance, their efficiency and the most important instruments used in them, while highlighting how to manage most of their financial risks.

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2 Financial Markets

There is a need for a specialized place where securities exchanges resulting from economic and financial developments are taking place, which has led to the emergence of the financial market as a place where debt, cash and financial assets exchanged. Financial markets have become the most connected instrument in the world due to the type of operations involved in currency, stock, bond, loan and securities markets as well as securities…

The financial market in its general sense is a system that includes a set of financial transactions that traded, and includes all organizations that act as financial intermediaries directly or indirectly, through one or more phases, whereby the shareholders (Investors) and their exhibitors (Savers) [1].

It is also a mechanism which financial assets are traded efficiently, efficiently transferring financial resources from surplus sectors to sectors with medium and long-term fiscal deficits, reflecting several benefits for borrowers and investors [2].

As a part of the financial system, the financial market "expresses the units which funds flow to the financial system according to a mechanism uses to combine economic agents by transferring surplus funds from agents with financial surpluses to agents with financial deficits while financial institutions act as intermediaries in the process of "Transfer" [3].

In this market, "Securities are sold and bought from shares, bonds and other financial instruments that can also be loaned and borrowed" [4].

Financial markets deal in so-called securities, other than the monetary market, which deals mainly in so-called commercial securities, and financial market institutions are located in countries where the banking system (banks) is integrated, where Includes investment banks, business banks, real estate banks, stock exchanges and insurance companies [5].

"As any market where supply and demand interact, prices are determined in the financial market according to the level of supply and demand" [5].

The growth in the level of modern means of communication and informatics reduce the importance of presence in the financial market in the temporal and spatial sense, allowing dealing from outside the market through brokerage companies spread in different countries because of the globalization of Financial activity and the merger of capital markets [6].

The deference between financial and monetary markets can explained by this comparative Table 1:

The financial market derives its concept from the concept of the market in general, it does not require a spatial space although it is a prerequisite for its increased efficiency, but it is sufficient to provide a communication tool between the seller and the buyer for the presence of the market.

3 Financial Market Functions

3.1 Financing

The objectives of the financial markets are to combine economic units with fiscal surplus and economic units with financial deficits, where they play an important role in achieving

Table 1. Comparative table between financial markets and monetary markets

Financial markets	Monetary markets
In which lending and borrowing takes place in the medium and long term, where supply and demand meet through people and institutions that own capital, investors are working to look for new capital, and securities are traded in this market through two main markets: * Primary market * Secondary market For financial institutions, they are businesses (banks, insurance companies or the stock market (stock exchange…	The short-term capital market, in which lending and borrowing from banking institutions takes place, is an interbank market, where banks resort to these markets to provide liquidity reserves in their central bank account to counter customer withdrawals, in addition to deals between them. The interest rate determined by the Central Bank in accordance with the monetary policy of the state Cash institutions defined as economic banking units. Represented as part of the financial market, particularly financial institutions, they link interbank operations, by accepting deposits and granting loans…

economic efficiency, because the management of funds has the key function in economic growth.

This is because economic activities play a role in the financial market with direct impacts on individual wealth, on companies, consumers and on economic flows [7].

3.2 Impact on the Economy

This effect is done by [8]**:**

- Providing funding of all kinds (short-term, medium and long-term).
- Be careful to convince savers to deposit their money with the lowest possible risk.
- The possibility of transferring ownership for investors and trading securities.
- Encourage financial transactions in terms of the sale and purchase of financial assets (i.e. investment and savings).
- Determining the prices of securities according to the financial position of the institution.
- Predicting the financial future and variables or financial parameters based on the current economic realities.
- Increase the flow of funds and bring investment to the local financial market.
- Providing the necessary liquidity and organizing sales and purchases.

The financial market also can do all this functions with two main factors: The choice of commodity (securities that trade at the market level), and the transmission of information and the transparency of the market [9].

4 The Development and Regulation of Financial Markets

4.1 The Development of Financial Markets

The main reason for the emergence and development of financial markets is the need for financing that provides the economy with capital, which is the most important component of production for economic activity.

This is what made the financial markets differ in their development from one market to another depending on the level of management, technology and the volume of transactions traded in the market… In the context of economic and political stability [10].

Financial markets evolve as a mechanism for mobilizing financial resources and directing them towards investment in order to stimulate financial operations and raise their potential returns, which have an effect on these markets, especially after the merger of financial and monetary markets on the one side, and between the local financial markets and international cooperation with each other simultaneously on the other side [11].

This development enables these markets to focus on long-term securities trading (stocks and bonds) because of their role in collecting national savings, and guiding them into investment channels that primarily support the national economy and thereby raise the welfare rates of individuals. This base on investor's desire for a larger base and the establishment of investment portfolios for a larger number of international securities and issues, allowing the development and expansion of financial markets. The "technological progress and communications factor that played the most important role in its growth along with the major investment banks" [12].

Changes in capital market technology have occurred at the level of the technologies and financial instruments available in the financial market, which have internationalized in a way that increases the flow of capital, and at the level of global capital market integration [12, 13].

Some of the most important factors that led to the development of these markets are:

- The accumulation of individual and national financial income sought to increase savings, allowing them to be use in financial markets.
- Limited use of financial resources, including the search for broader areas of investment.
- The wide spread of technology in the face of large investments and capitals.
- The development of financial intermediation and the specialization of brokers in the transfer of funds according to exchanges (buy and sell).
- The development of the tools used in these markets to improve financing and investment conditions.
- The diversity and diversity of services makes them constantly evolving.
- Motivate clients to improve their financial performance and obtain higher returns with lower risk and greater liquidity.
- The development of regulation and laws governing these markets with the aim of contributing to their development.
- The interdependence of global economies due to internationalization and financial globalization has allowed the development of international economic relations.

- The internationalization of financial institutions' activity focuses on obtaining substantial resources to the expansion and development of their financial operations due to conglomerates, mergers and concentrations.
- Working to achieve financial stability to strengthen and strengthen dealing in these markets.

However, their effective and efficient role depends on their ability to develop the size of the market and strengthen their institutional and regulatory structure in order to maximize the benefits and reduce the risks of financial liberalization, particularly capital account liberalization and the integration of global financial markets [14].

4.2 Develop Market Size

Depends on the development of both sides of the demand for securities and supply in the stock market.

- *Demand-side development:* Depends on strengthening demand by non-banking institutions, deepening investment awareness to increase domestic demand for individuals as well as encouraging foreign demand and maintaining market stability.
- *Supply-side development:* The supply side of the stock market activates by diversifying the offer of stocks and bonds offered for public offerings as well as new instruments, the most important of which are convertible bonds, saleable bonds, bonds accompanying stock rights, as well as Derivatives, securitization, and listing of Islamic securities or sukuk [15, 16].

5 Developing the Infrastructure of the Stock Market

A stock market requires a set of regulations and mechanisms that manage transactions in the market, and contribute to raising the level of market efficiency, and these mechanisms form with the regulatory structure of the market, which affects the performance of the market as a whole, and the process of developing the market infrastructure link to many Factors including:

- Improving regulation and management and working to stabilize and regulate the market.
- Developing institutions operating in the capital market because of their role in stimulating the market, by investing in their portfolios of securities, as well as promoting and underwriting securities, risk management and portfolios. As brokerage firms (underwriting companies and brokerage firms), investment companies, portfolio formation and management companies…
- Promoting the regulatory role of the market and transparency through the dissemination of information, preparing financial statements in accordance with global accounting regulations, reducing internal information-based trading, and controlling foreign exchange.

- Development of settlement, clearing and central conservation systems: a rapid and secure system of settlement, clearing and central conservation is a key pillar for the market to function efficiently and increases its liquidity, making dealing attractive to both domestic and foreign investors [17].

6 Regulating the Financial Market

The financial market allows interaction between agents with financial deficits and agents in the event of a financial surplus. It employs under the control and authority of the market thanks to financial intermediaries who provide indirect financing to the economy.

The rules of procedure also ensure that the financial market operates well through the organization of this body and the development of tight management plans, the establishment of bodies that protect the interests of investors and the public interest, as well as the maintenance of free and open financial markets.

In addition to the securities issuers and underwriters, we also note the financial authorities and intermediaries [18].

7 Financial Market Performance Forms

The financing method of the financial market aimed at transferring financial assets from those who are able to save to borrowers. Thanks to arrangements for creating and exchanging rights for any financial assets among its clients, the financial industry contributes to reflect the image of the performance of the financial market, which in turn reflects the strength of the financial system. The financing process in the financial system takes the following forms: [19]

- ***Direct finance:*** Direct financing is dealt directly between financed savers and investors willing to invest, without mediation. The borrower receives financial resources in exchange for issuing direct financial assets (shares, bonds and other documents) to the lender. Financial obligations calls direct financing with direct or primary financial assets because they will transfer from the holder to the right holder.
- ***Indirect financing:*** Through intermediary financial institutions that include economic institutions that facilitate the flexible convergence of savers and borrowers. Whose role may go beyond local financial brokerage to global financial intermediation, such as commercial banks, insurance companies, credit, finance companies, mutual funds.

8 Financial System Means and Tools

8.1 Financial Asset Rating

Since financial assets do not represent direct ownership by individuals, but rather express indirect claims to ownership of real assets, financial assets can divided according to their nature to [20]:

- Tangible assets that depend on the value of the tangible asset in its physical properties.

- Intangible assets representing legal rights that entail a particular benefit [21].
  Which has its general characteristics: [22] [23]
- Great homogeneity in their units unlike real assets.
- Having sophisticated markets to deal with them.
- It gives the owner the right to claim the income generated at the time of maturity.
- Liquidity: High liquidity when liquidity needed in the economy.
- Risk and uncertainty, where the degree of risk consider higher than the risk of real assets.

9 Components of Financial Markets

The stock market where securities issued by financial institutions traded, where we distinguish two types of financial market [24]:

9.1 Present Markets

Securities trade in regulated markets within a designated and well-known place called the stock exchange, or outside of this place, which know as unregulated markets. There dealt immediately between the seller and the buyer [25].

- Regulated primary markets in which new securities issue for sale for the first time.
- Regulated secondary markets that include stock exchanges where these securities trade.

9.2 Deferred Markets

It brings together options, swaps, futures, and futures contracts or so-called derivative markets, which also deal in stocks and bonds, but through contracts and agreements that execut later, not at the time of the deal to buy or sell or both. In other words, the buyer pays the value of the security to receive it later. The purpose of these markets is to avoid the risk of price changes [26].

10 Types of Financial Markets

Financial markets are an essential means of choosing the best sources of financing among economic agents, which can classify according to their core characteristics to [27]:

- The government's policy of "de-interest" is to provide the necessary financial support to the government.
- The debt market and the private money market
- Organized and unregulated markets
- Primary and secondary financial markets

The first classification distinguishes between capital markets, which represent the meeting place for exhibitors and students on capital in a specific and regulated space, i.e. medium- and long-term money dealing. Investment banks, insurance and savings funds operate where long-term securities are traded (ordinary shares, premium shares, bonds…) " [28].

Money markets, which represent markets where money transferred through short-term financial instruments, less than three months. These securities are characterized by high liquidity (deposits, treasury bills, certificates of deposit, commercial securities…) " [29].

These markets achieve the advantage of dealing in one specific place where all buy and sell orders meet on restricted contracts, through financial intermediaries, and the receipt of all buy and sell orders in one place leads to a large number of sellers and buyers, allowing for a high level of liquidity.

Using the market's ability to issue as a rating standard. We distinguish two types of markets: primary and secondary financial markets [30].

10.1 Primary Financial Markets (Issue Markets)

In the initial market, the seller of the security is the source of the securities, and it is first subscribing directly between the source of the paper and the first underwriter by creating the securities. This allows for the emergence of a relationship between savers and investors, mediated or without mediation.

Its primary function is to combine savings and investments. Its importance is reflected in the provision of financing for investment in the economy, i.e. allowing the formation of physical capital (in-kind investment), and the actual contribution of financial markets appears in the unregulated primary financial markets through which they are not dealt with in a specific and regulated place.

10.2 Secondary Financial Markets (Trading Markets)

Markets where securities issue on the initial market trade, re-selling and buying securities, dealing with previous issues. It plays an important role in mobilizing savings and stimulating the use of funds Reinvested through financing provided by productive economic units.

There is a strong relationship between primary and secondary markets by expressing the efficiency of the financial market [31].

Then "The prices of securities traded in the primary market are determined by the secondary financial market by supply and demand parameters."

11 The Efficiency of Financial Markets and Their Economic Importance

According to the concept of efficiency, which expresses the response of securities in the financial market to every new information received to its customers can change their perception of the issuing institution of the paper. "Stock prices are moving up or down

depending on the information available in the market" [32]. We can determine Efficiency by two factors:

1) Availability and timely availability of securities information to all investors.
2) The person based on the specialized process to understand, perceive and interpret information.

The theory of efficiency does not explain the efficiency of the information but the impact of the information, as the information may be incorrect and nevertheless affect decision-making in the financial market.

- Internal efficiency: Low exchange cost in the financial market i.e. financial transaction costs.
- External efficiency: The speed of adjustment and responsiveness of the prevailing prices to new information.

12 The Importance of the Financial Market

The role of capital markets is critical in developing the economy and accelerating development rates, and in providing financing reserves as countries move to economic liberalization and financial liberalization thanks to the diversion of fiscal surpluses [17].

Most countries now pay close attention to stock markets, due to the active role they play in securing liquidity and attracting foreign investments, as the latter contribute to the completion of public and private economic projects and schemes, thus contributing effectively to economic development.

13 The Risk

The Latin word "Rescass" meaning the occurrence of a change compared to the stable or equilibrium situation, or the occurrence of a deviation from the expected results. It describes the concept of separation of an expected state. As for idiom, it expresses the commitment that includes uncertainty and suspicion, with possible losses [33].

"Exposure to an adverse circumstance or" situation "in which the possibility of an opposite deviation of the desired result, expected or hoped for, is occurring. It is subject to a set of external conditions, which leads to the possibility of material losses."

In addition to the fact that the risk is the possibility of the event occurring, it also expresses the failure to anticipate or desired outcome from the investment, which leads to losses.

14 Risk Analysis

The value of the security is determined in the market in light of the return and the risks, the size of which must know it before the investor reaches the investment decision. We can categorize risks: business and financial risks, static and dynamic risks, purely and speculative risks [35].

15 The Instability of Financial Markets

The equilibrium of the financial market means the stability of prices for each financial asset, Demand is equal to Supply, and according to a unified price law, the degree of fluctuation of the financial market indicates the presence of fluctuations in the level of prices of financial assets.

Its stability and the instability of the market, and the degree of instability can measure the variation in monthly returns, and usually the low degree of volatility in the market prices means an indication of its development and development [36].

16 Factors Affecting the Behavior of Financial Markets

We can identify the various factors that affect the behavior of financial markets according to two main factors:

- *Basic factors:* whose source is outside the financial market, and their effects reflected on the market behavior, as they relate to various economic developments and levels of economic activity as a whole. These factors are outside the financial market, as they do not arise within it, but rather can expected it to affect the behavior of the market.

  Moreover, these factors affect the prices of securities.
- *Technical factors:* they arise within the market, and they relate to the nature of the operations that take place in it, according to the way investors treat it and the operations that they perform. The various factors affecting the behavior of financial markets are:

16.1 Financial Policy

It means the means of financing government spending, and its effect on the policies used in financing, for example the reduction of taxes that considered among the countries policies in achieving financial resources. This reduction stimulates the investment factor, which pushes institutions to expand their activities, which leads to higher production. In addition, from it increase the amount of profits achieved [37].

The opposite happens if the tax rates raised, which means that the profits of the institutions decrease, including the decrease of their share prices in the financial market.

16.2 Monetary Policy

Monetary policy means the extent of the government's ability to control the money supply offered in the economy, from the deposits of current deposits in banks in addition to the cash available to individuals. The relationship between monetary policy and the level of stock prices lies in the variables affecting them [37].

16.3 Exchange Rate

The exchange rates have an important impact on the conditions of the financial markets, as the depreciation of the currency leads to the purchase of securities, which have returns in a high value currency in exchange for the low local currency [38].

16.4 Inflation

Inflation reflects lower purchasing power, as higher prices (inflation) are not appropriate for higher prices on the stock market [40].

16.5 Interest Rate

The valuation of securities that represent financial assets at one point based on the prevailing interest rate in the financial market, which reflects the price of money. The higher the interest rates, the more it affects the collapse of the stock prices. This drives investors with a preference among many forms of employment with fixed and low returns previously known without incurring any risks, and between bearing risks and obtaining high and variable returns [40].

17 The Volume of National Production

The volume of production may have a positive or negative impact on stock prices. The unexpected increase in real economic activity increases optimism in the future, which increases the movement of shares trading, and hence their price increases. The opposite occurs when the economy exposed to crises, which affects the volume of transactions in the financial market and the returns of securities [42, 43].

18 Conclusion

Financial markets are the most important components of the economy in any country, because they have a very important role in the economic and industrial development that most countries. The international financial market includes a relatively limited number of large international financial centers which the majority of financial operations carried out [45].

In light of the current developments characterized by globalization and the changes it brought about the economies of countries, and their role in the development of financial markets and their impact on financial transactions that involve risks, the necessity of identifying possible means for managing risks and the various factors affecting their behavior appears. The degree of interdependence and dependence is tremendously growing between financial markets and international economies requires more stringent in dealing with financial assets and their flows at the global level, and This indirectly affects global financial transactions and development.

References

1. Cougnanir, B.: L'univert Des Risques En Finance – Un Equilibre En Deveir-, Sciences Po, Paris (2007)
2. Bodie, Z., Merton, R.: Finance. Pearson, Paris (2005)
3. Mishkin, F.: Monnaie, Banque Et Marché Financier. Pearson, Paris (2007)

4. Choinel, A., Rouyer, G.: Marché Financier- Structure Et Acteurs-, Collection Bq Itb, Paris (2010)
5. Bourachot, H.: 100 Fiches Pour Comprendre La Bourse Et Le Marché Financier, Paris (2010)
6. Barneto, P., Gregorio, G.: Finance. Dunod, Paris (2013)
7. Joudi, M.: Bourse Des Valeurs Et Marché Financier(2006) www.Firmarkets.Com
8. Bailly, J.-L., Caire, G., Figliuzzi, A.: Economie Monétaire Et Financière
9. Ottavj, C.: Monnaie Et Financement De L'économie. Hachette Livre, Paris (2010)
10. Cobbaut, R.: Théorie Financière. Economica, Paris (1997)
11. Simon, Y.: Encyclopédie Des Marchés Financiers. Economica, Paris (1997)
12. Chavagneux, C., Milwiski, F.: Les Enjeux De La Mondialisation. La Découverte, Paris (2007)
13. Bhattacharia, A.: La Mondialisation Financière Se Heurte A La Crise. Revue Problème Economique, N° 2976, Avr 2009
14. Ranson, G.-P., Chesneau, D.: Trésorerie, Risques De Marchés Et Gouvernement D'entreprise, Paris (2008)
15. Aldoseri, M., Worthington, A.C.: Risk Management In Islamic Banking (2008)
16. Makiyan, S.N.: Risk management and challenges in Islamic banks. J. Islamic Econ. Bank. Finance **4**(3), 45–54 (2008)
17. Guill, D.: Bankers trust and the birth of modern risk management. J. Appl. Corp. Finance **28**, 19–29 (2016)
18. Chauveau, T.: L'équilibre D'un Marché Financier. Lavoisier, Paris (2004)
19. Collomb, J.-A.: Finance De Marché. Eska, Paris (1999)
20. Rebereau, M.: Les Indices Economiques Et Les Marchés Financiers. DUNOD, Paris (2008)
21. Dif, A., Hamdani, Z.: The economics of intangible assets: from just value-to-value creation. Advances in Human Factors, Business Management and Society Proceedings of the AHFE (2019)
22. Cougnanir, B.: L'univert Des Risques En Finance –Un Equilibre En Deveir-, Sciences Po, Paris (2007)
23. Luisot, J.-P., Gautier-Gaillard, S.: Diagnostic Des Risques. Afnor, Paris (2007)
24. Dallene, P.: De L'internationalisation A La Globalisation. Ellipses, Paris (2007)
25. Masood, O., Al Suwaidi, H.: Credit risk management: a case differentiating Islamic and non-Islamic banks in UAE. Qual. Res. Financ. Market **4**(2/3) (2012)
26. Amelon, J.-L.: Les Nouveaux Défis De L'internationalisation «Quel Développement International Pour Les Entreprises Après La Crise?». De Book, Bruxelles (2010)
27. Erik, B.: The Credit Risk of Financial Instruments. Macmillan Business, London (1993)
28. Santos, J., Syed, L.: A Talk On Global Financial Crisis (2008)
29. Caudamin, G.: Banque Et Marché Financier. Economica, Paris (1998)
30. Jacquillat, B., Solnik, B.: Marché Financier: Gestion De Portefeuille Et Des Risques. Dunod, Paris (1997
31. Jura, M.: Technique Financière Internationale. Dunod, Paris (2003)
32. Brigham, E.F.: Fundamentals of Financial Management. The Dryden Press, USA (1998)
33. Percie Du Sert, A.: Risque Et Contrôle Du Risque. Economica, Paris (1999)
34. Bouyssou, J.: Théorie Générale Du Risque. Economisa, Paris (1997)
35. Kuester, K., Mittnik, S., Paolella, M.S.: Value-at-risk prediction: a comparison of alternative strategies. J. Financ. Econom. **4**, 53–89 (2006)
36. Boucher, B.: Les Crises Financières «Identification Et Comparaison Des Crises Boursières». Ela Documentation Française, Paris (2004)
37. Christoffersen, P.F.: Elements of Financial Risk Management, London (2003)
38. Ben Selma, M., Echchabi, R., Azouzi, A., Rachdi, D.: risk management tools practiced in Islamic banks: evidence in Mena region. J. Islamic Account. Bus. **5**, 90 (2014)
39. Bergsdorf, D.: Manager Your Risk or Risk Your Management. Public Management, USA (1999)

40. Cummins, A.D.: The Rise of Risk Management, Economic Review. Federal Reserve Bank of Atlanta (1998)
41. Penny, C.: Financial Risk Management Sources. Inconstant, vol. 22, no. 6 (1999)
42. Stewart, T.A.: Management Riskin The 21st Century. Fortune, vol. 144, no. 03 (2000)
43. Angelopoulos, P., Mourdoukoutas, P.: Banking Risk Management in a Globalizing Economy. Qourum Books, London (2001)

From Sales Funnel to Customer Journey

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Abstract. Digitalization is continuously changing people's ways of searching and buying products and services. Digital platforms, especially around the internet, are radically changing the people's ways to share experiences and interact with each other. A company that implements the elements of the change to its processes gains an overwhelming competitive edge in the market. The connection between sales and digital marketing is in a vital position, considering the new opportunities that are created by digital transformation and the new digital platforms. In this article, the modern customer journey is reviewed through a step-by-step analysis. The connection between customer experience, digital marketing, and companies' core operations is defined and analyzed in the changing digital environment.

Keywords: Customer journey · B2B sales · Digital marketing · Customer experience

1 Introduction to Customer Journey

The Customer Journey is the journey of how a customer becomes aware of the brand, the way a customer interacts with it, and the experience a customer creates of the interaction. It is the entirety of experiences and actions that a customer goes through when interacting with a company and its brand. Mapping out a customer journey is in a vital position when defining, developing, and improving a company's customer journey [1].

Mapping starts with defining the stages of a Customer Journey. These stages involve customer touchpoints, which represent the occasions when a customer is in contact with a company and its brand. The more customer touchpoints a Customer Journey has, the more complicated the mapping becomes the entirety wider. Concurrently, the mapping becomes more necessary to understand and to develop the customer journey [1]. The outcome of a Customer Journey is Customer Experience. It is the impression that a company gives to its customers through the touchpoints and different stages of a Customer Journey, resulting in how the customer thinks of a brand.

A company must manage the customer journey by building valuable relationships with their customers. Customer Relationship Management (CRM) is a business approach that pursuers to create, develop, and enhance a company's relationships with customers. The objective of Customer Relationship Management is to improve the value

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that is offered to the customers and, seemingly, the company's profitability. It aims to increase the acquisition and retention of profitable customers. Customer relationship management often merges with information technology and the implementation of relationship marketing strategies [2]. Relationships with business-to-business customers are dynamic, and they evolve during the relationship over time [4]. The dynamics of these relationships are changing as a result of changes in the business-to-business environment. Branding emerged to give a competitive advantage to mass production, which led to the point where consumers based their opinions on the brand's reputation rather than their own experience. Successful branding still has a strong influence on the profitability of a company. However, the means are in evolving as digital platforms create possibilities to achieve a global brand reputation faster than ever before. Besides, much of that reputation is based on the experience and interaction shared around the brand. The customer relationship dynamics are continuously evolving as the era of interaction, and communication has emerged to challenge the brands. Companies are strategizing on how to gain sustainable competitive advantage by thriving customer information and interaction. As social media and other digital platforms have created a transparent environment, companies have realized how important it is what customers say about them. The focus must be more on the customers rather than on the company [3].

The five phases that a customer relationship can evolve are awareness, exploration, expansion, commitment, and dissolution. Awareness is when a customer becomes aware of the company for the first time. Exploration is a phase when the customer is engaging with the brand and evaluating the brand. During this phase, the customer develops an image and idea of the company through available information and interaction. The phase of Expansion is when the trust between the brand and customer commences developing. Commonly this phase consists of more profound communication between the parties, which often include purchases, co-operation, and meetings. However, at this phase, the customer is not yet entirely committed. All the relationships do not reach the next phase, which is Commitment. The phase of commitment requires focused trust and increased adaptation. The development of trust can be described as an investment in the relationship, which supports long-term objectives. Both parties are motivated to make investments in the relationship when it has trust and commitment. When thinking of the phases of a Customer Journey, a company has to know its strategy. For example, reaching the commitment phase is crucial when a company wants to build successful long-term relationships [4].

These phases can be found from the different levels of the customer relationship. The levels can be divided into six: prospect, buyer, client, supporter, advocate and partner. Transforming customers from a level to another requires effort from the company. In business-to-business relationships, the objective is most commonly to make customers brand advocates or partners [4].

Customer relationship management is adapted to a company through multilevel management, which usually includes process, organization, technology, and culture management. It focuses on long-term value rather than the short term, as the relationship gets more valuable during the time. It is not abnormal that some of the customer relationships bring losses to a company in the short term but will pay off in the long run. Customer equity is a good indicator when measuring the value of a customer. The term customer

equity defines the effectiveness of customer relationship strategies and their implementation. Also, it describes the lifetime value of all the customers of a company, which regards the interaction and transactions during the Customer Journey. It is measured by the revenue that a customer brings to the company, minus the costs of customer acquisition and customer service [3].

2 Connection Between the Sales Funnel and Inbound Marketing

The exponentially growing use of digital platforms has significantly transformed how companies sell and market their products and services. Communication between companies and their customers used to be visits, letters, and calls. Today there are a growing number of ways for customers to connect directly with a company at any time or location. The use of Chatbots, WhatsApp, Instagram, and other digital platforms has become common in B2B relationships [5].

The three main changes that digitalization has produced are a shift in customer behavior, a change in technology, and a change in the market. As customer behavior changes, companies need to keep up and learn about their customers' occurring habits. Increasingly customers dictate how, where, and when they want to do business. The digital platforms have opened a global rivalry, which means that if one company fails to meet expectations, the customer easily finds other options. Technological change has enabled the whole process of digitalization and digital transformation. As technology has never been as easy to get and affordable as it is now, it has become ubiquitous and commoditized. The most frequent obstacle in many businesses is the lack of understanding of how and when technology can be used. Digitalization molds the market, the rivalry, and the operating environment continuously. New competitors emerge quickly from other countries, and in some cases, even from scratch. Many of these new competitors are following the habits, operating logic, and business models of the digital age. This kind of modern competition makes success difficult for traditional companies. Moreover, digitalization offers businesses new ways to grow, reach potential customers, and expand into new markets globally [5]. The changes in buying behavior are forcing companies to adapt their strategies to fit the increasing digitalization of the purchasing process. This is where the connection between the sales funnel and inbound marketing steps into the picture.

The sales funnel starts with a cold prospect who has not discovered the company yet. After the prospect sees the product or service, they will evaluate it by using the information provided by the company. The customer seeks to value and compares offerings between various companies. Interested prospects continue their journey through more profound interaction with the brand. After that, they find to have contact with a sales representative who discusses with the prospect and closes the sale [6].

The inbound marketing funnel is based on the same ideology as sales funnel. Inbound marketing funnel's steps focus on creating value, trust and interaction between the potential customers and a company. The goal is to be present where the potential customers are and to interact with them at the right time during their journey. The funnel is based mainly on digital platforms [7]. At the top of the funnel, prospects are looking for a solution for a problem or need. They start looking for information to meet their needs.

At this point, the value of these prospects is still low because the probability of buying is uncertain [8].

During the phases of the inbound sales funnel, the company provides content to the prospects and interacts with them. The main objective is to provide answers to their questions and solutions to their problems at the right moment [8]. As the prospects reach the middle of the funnel, they have already recognized that the company could fulfill their need. They are more committed to buying. At this phase, a company has to prove that its solution meets the need of the customer. When prospects reach the bottom of the funnel, they are ready to make the purchase decision. According to The Marketing Blender, the buyers' journey is made 68% digitally [9]. It is essential to help the prospect to make the purchase decision so that they will not end up with the competitor's services or products [8]. After the purchase, the Customer Journey continues.

3 From Sales Funnel to Customer Journey

In this chapter, the Customer Journey is analyzed on three levels, which are customer touchpoints, operations during the customer journey, and the customer journey phases. The customer journey is defined from the first touchpoint to managing the customer relationship. The analyzed information is illustrated as a diagram as well as described in writing.

3.1 Customer Touchpoints

The touchpoints during the customer journey are divided into four stages. The four stages are the first touchpoint, before purchase, during purchase, and after purchase, as seen in Fig. 1. These touchpoints can be divided into two categories, which are physical and digital touchpoints. These touchpoints can vary between different companies.

A customer journey starts when customers have their first experience with a company. Physical first touchpoints can be, for example, word of mouth and live events. Digital first touchpoints could be Google, social media advertisement, company's social media channels, employees' personal social media channels, referrals, or email. These digital touchpoints are divided into two categories: inbound and outbound. Most of the digital channels are categorized as inbound. However, in most cases, email as a first touchpoint is used for outbound, for example, by sending email campaigns before cold calling.

After customers' have had their first experience, they continue to discover more and move on to the next stage: Before purchase. During this stage, it is crucial to be able to provide information that adds value to the customer as the customer is continuously evaluating the information and experience. At this stage, the touchpoints could be such as downloadable material, website, blog, social media following, email campaigns, and phone calls. Through these interactions, customers will get valuable information for their needs, as well as to nurture the idea of fulfilling their needs with the company's offering. Simultaneously, the company will get information on the customers' needs and encourage them towards the next step.

As the customers take the step closer to the purchase, they step into the phase of During purchase. During this phase, the touchpoints could be a website, newsletter,

Fig. 1. Customer journey phases on top, customer touchpoints in the middle and under operations during the customer journey

meetings, offer, and contact. The idea is that these touchpoints are leading towards a customer relationship. The customer is still evaluating the options but acknowledges having a need that must be met. It is crucial to go to the core of the need and to provide value and prompt solutions to fulfill it. As the customer decider to purchase, the stage of After purchase commences directly. The touchpoints of this stage could include billing, reports, maintenance, and follow-up meetings. It might as well include client letters or social media following depending on the customer's wishes. However, the main idea is to keep in touch with the customer.

3.2 Operations and Phases

The operations during the customer journey could be such as content creation and data-analysis, lead nurturing, sales, and relationship management. The departments operating these actions are, in most cases, are Digital marketing, Sales, and Project teams, and Sales. The responsibility of the potential clients' nurturing is changing from a department to another as the potential customer proceeds on the journey. The customer journey consists of six phases, which are awareness, discovery, evaluation, conversion, purchase, and relationship management. Each of these consists of touchpoints and operations, as seen in Fig. 1.

The customer journey begins with awareness, which means that the customer recognizes the brand for the first time. The phase of awareness is mainly operated by marketing and sales, who's operations create brand awareness through the first touchpoints. As the customers have become aware of the company, they continue to discover the brand through provided material. As the customers are discovering the brand, they look for answers and solutions. Furthermore, they are looking for answers to their problems, and whether their needs can be fulfilled or not. They evaluate the given information and interact with the brand. They might provide their contact information for the company to

receive more detailed information or offers. However, they are not ready to purchase yet. The touchpoints during phases discovery, evaluation, and conversion are the touchpoints before the purchase. The customer chooses to convert or not, based on their experience and estimate. Converting is often a direct sign of intent to buy, which means that the prospect is becoming more valuable.

In most cases, after converting, the customer could have meetings with a representative and receive an offer. After receiving the offer, the customer probably weighs the options and might put the offer out to tender. At this point, the company's most important task is sure that customer's need is taken into account, and all the questions are answered. As the customer decides to purchase, the phase of commitment starts to develop directly. Commitment is built through Relationship management, which includes all the touchpoints after the purchase, which will lead to trust and commitment by time.

4 Conclusions and Recommendations

To be able to master the digital changes in the customer journey, a company needs to understand the change. Due to digitalization, in many different fields, the customer journey evolves from digital channels. As the buyer behaviors are changing, a company must be able to give a personalized and seamless experience without meeting the customer physically. When a company understands the change, it can gain an overwhelming competitive advantage.

The customer journey described is made as part of the research conducted in 2019 [10]. Based on the research, it is recommended to investigate the customer journey more in detail to define the customer journey of a company. The customer journey is a complex entity and depending on factors that might not have been taken into account in this article. The study of a customer journey could go further into the details as each part of the study could be studied individually.

References

1. Richardson, A.: Using customer journey maps to improve customer experience. Harvard Bus. Rev. (2010). http://www.iimagineservicedesign.com/wpcontent/uploads/2015/07/Experience-Maps-Using-Customer-Journey-Maps-to-ImproveCustomer-Experience.pdf. Accessed 26 Sept 2019
2. Payne, A.: Handbook of CRM: Achieving Excellence in Customer Management. Routledge (2005). https://ebookcentral.proquest.com/lib/turkuamkebooks/reader.action?docID=255230. Accessed 11 Dec 2019
3. Peppers, D., Rogers, M.: Managing Customer Relationships: A Strategic Framework. Wiley (2016). http://ebookcentral.proquest.com/lib/turkuamk-ebooks/detail.action?docID=4729311. Accessed 12 June 2019
4. Buttle, F.: Customer Relationship Management. Routledge (2003). http://ebookcentral.proquest.com/lib/turkuamk-ebooks/detail.action?docID=289003. Accessed 11 Dec 2019
5. Ilmarinen, V., Koskela, K.: Digitalisaatio: yritysjohdon käsikirja. Talentum 2015 (2015). https://bisneskirjastoalmatalentfi.ezproxy.turkuamk.fi/teos/IACBGXCTEB#kohta:DIGITALISAATIO((20)/piste:b4. Accessed 28 Nov 2019

6. Bristol Strategy: What is an Inbound Marketing Sales Funnel? (2019). https://www.bristolstrategy.com/what-is-an-inbound-marketing-sales-funnel. Accessed 25 Oct 2019
7. HubSpot: Inbound marketing strategy (2019). https://www.hubspot.com/inbound-marketing. Accessed 25 Sept 2019
8. Booth, K.: Why Inbound Marketing is Necessary at Every Stage of the Sales Funnel. HubSpot (2014). https://blog.hubspot.com/insiders/inbound-marketingfunnel. Accessed 25 Oct 2019
9. The Marketing Blender: Statistics Every B2B Company Should Know to Boost Sales and Get More Customers (2019). https://www.themarketingblender.com/statistics-boost-sales/. Accessed 1 Dec 2019
10. Venermo, A.: Defining a business-to-business customer journey. Theseus (2019). https://www.theseus.fi/bitstream/handle/10024/266592/AlinaVenermo-the-sis_CompanyX.pdf?sequence=2&isAllowed=y. Accessed 1 Jan 2020

Business Development

Concurrent Research and Decentralized Decision Making as an Accelerator from Idea to Business – Case Turku Finland

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Abstract. In the world of constant change, societies, public institutions and private companies have to adapt themselves quicker and quicker. Today´s rapid changes in economy and business, caused by other hand globalization and another hand by quick changes in commercial relationships between major economic powers in the world, changes the world and businesses literally overnight. Disruptive innovations creates and destroys businesses as well. In these circumstances, need for rapid process from idea to business is more needed than ever before. Especially, in branch of health technology, development for solutions and systems is long and demanding process. This article handles process from idea to business by creating concept, which utilizes concurrent engineering methodology. Article creates the concept by integrating state of the art research from this domain and scrutinizes it´s suitability to be base for intermediary platform for medical device product development.

Keywords: Concurrent engineering · Innovation process · Knowledge · Management · Health technology

1 Introduction

The field of healthcare is changing fast. This change has multiple dimensions. On the one hand, the change is related to ageing societies and related economic aspects. On the other hand, the change is related to changing users – their preferences on service supply and use. In order to cope with the change that is a constant factor in today's healthcare business as well, the companies need rapid and flexible co-creation services. The co-creation services of today are more than laboratories of the past, they are modern facilities where premises and people come together in a way that creates simulated, or real-world, conditions for testing their products. This article depicts how healthcare testbed services are provided in the South-Western Finland, and what is the underlying scientific rationale behind those services.

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Concurrent engineering (CE), also called for simultaneous engineering, is a methodology where different tasks such as design engineering, manufacturing engineering, market analysis, sales and customer relations together with other functions are integrated. It utilizes an integrated product team approach and goal is to reduce time needed to bring new products to markets. In short, CE bases on: 1) concurrent workflow, 2) early involvement of all participants needed in product development process, and 3) teamwork [1]. CE practices have contributed a lot to product development processes in the sake of efficiency and effectiveness by enhancing the degree of integration. Nowadays the research is more prone to Set-Based Concurrent Engineering (SBCE), where approach takes into account dynamic situation and considers sets of alternative paths for solution [2–4]. The more traditional version of CE is Point-Based Concurrent Engineering (PBCE), in which proceeding happens by moving only one factor each time [2, 3, 5]. As difference to PBCE, SBCE narrows the variety of possible solutions by using sets during the development process [6]. In a sense, the difference is in the mind-set. SBCE favors more iterative approach with enriching the possibilities rather than selecting the one promising approach, which is the case in PBCE that utilizes the "waterfall" analogy. Therefore, in this article, we concentrate to SBCE. SBCE is methodology and concept for bringing elements of Lean into product development process environments [7, 8]. SBCE concept, in the beginning, could be summarized to five main points: 1) Define a set of solutions at system level 2) Define sets of possible solutions for various subsystems, 3) Explore possible subsystems in parallel, using analysis, design rules, and tests to identify a set of possible solutions 4) Use the analysis to gradually narrow the set of solutions, converging slowly toward a single solution and use analysis of the sets sub-systems to determine appropriate specifications and 5) Once the set is narrowed down, stay with the decision and avoid changes, unless absolutely necessary [9]. This approach is be illustrated by Fig. 1.

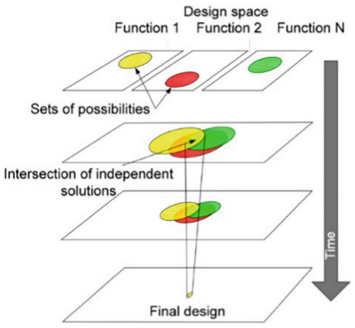

Fig. 1. Illustration of SBCE [10]

Distinguished principles are developed in to SBCE later and these could be compared quite analogically to the main principles of lean as guidelines. Principle 1) Map the design space a) Define feasible regions b) Explore trade-offs by designing multiple alternatives c) Communicate sets of possibilities, Principle 2) Integrate by intersection

a) Look for intersections of feasible sets b) Impose minimum constraint c) Seek conceptual robustness, Principle 3) Establish feasibility before commitment a) Narrow sets gradually when increasing detail b) Stay within sets once committed c) Control by managing uncertainty at process gates [11]. In order to get best possible results from SBCE, it also needs the measures how the organization or network of organizations should integrate or develop their activities. This point-of-view could be found from the former researches done in other highly demanding industrial domain. CE has been utilized also in demanding systems development such as aerospace industry. From these experiences, there is good illustration of framework to utilize and adapt in health technology product development processes. From Fig. 2, it is seen that there is three different dimensions to integrate, analysis dimension, product-services dimension and structure dimension. With this approach, all main dimensions of product development process could be covered. It takes stakeholders´ needs, products´ life cycle and structure of the product into account [12].

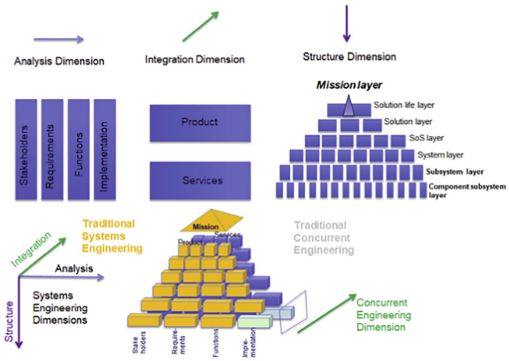

Fig. 2. Total view framework for systems concurrent engineering [12]

As this article handles the concept for idea to business in health technology domain, risk evaluation and handling should be one of the matters that should be integrated to concept. Former researches introduce the concept for Intelligent Risk Mapping and Assessment System (IRMAS™). It is developed to capture, assess, organize, store, share and update project related knowledge to support risk management in multisite, multi-partner CE projects [13].

Figure 3 is illustrating the concept for risk handling in decentralized SBCE. It shows the main matters and actions in order to evaluate and avoid risks in SBCE product development project. Even that there are evidences that SBCE is not very suitable for radical innovations as well as in incremental development. Companies that has utilized SBCE methodology in radical innovations which in nature possess a high level of uncertainty, novelty and complexity have not obtained positive results in development time or new product superiority compared to older methods [14]. When scrutinizing this above handled entity of CE we came to conclusion that SBCE would be the concept and domain, which we are utilizing in TERVA-project in order to get best possible framework for co-development of health-related innovations in healthcare testbeds. The aim of the

TERVA-project is to create an Intermediary Platform, which brings together all healthcare testbed services provided in the Southwest Finland and provides tools for finding the most suitable testbed services for the companies.

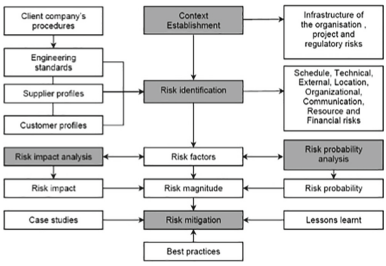

Fig. 3. IRMAS^{TM} Concept for risk mapping and assessment [13]

2 Medical Device

Medical devices play an essential role in the healthcare. Medical devices are products or equipment intended generally for a medical use. Medical devices regulations and legislation ensures the safety and efficacy of medical devices and facilitates patients´ and citizens access to devices in the global market. Medical device market is highly regulated and in order to produce a product for medical purpose, regulatory affairs most follow. If a product is classified as a medical device, it must follow regulatory rules before its release to the market. In European Union, a CE mark is a proof that these requirements are met, and laws and regulations of medical device development have been followed.

According to the World Health Organization (WHO) 'Medical device' means any instrument, apparatus, implement, machine, appliance, implant, reagent for in vitro use, software, material or other similar or related article, intended by the manufacturer to be used, alone or in combination, for human beings, for one or more of the specific medical purpose(s) of:

- diagnosis, prevention, monitoring, treatment or alleviation of disease,
- diagnosis, monitoring, treatment, alleviation of or compensation for an injury,
- investigation, replacement, modification, or support of the anatomy or of a physiological process,
- supporting or sustaining life,
- control of conception,
- disinfection of medical devices
- providing information by means of in vitro examination of specimens derived from the human body;

and does not achieve its primary intended action by pharmacological, immunological or metabolic means, in or on the human body, but which may be assisted in its intended

function by such means." Therefore, based on the definition, also software applications can be considered as medical devices and thus, the developer of such applications must follow the strict regulation of a medical device manufacturer [15, 16].

3 Intermediary Platform

In Finland, testing and co-development of health-related solutions is commonly done in organizations that either offer health services, or train future healthcare professionals, in the healthcare testbeds of these organizations. However, there are fundamental problems associated with this kind of service composition. Firstly, the companies that need testbed services are not always aware of the availability, scope or limitations of the provided services (reachability problem). Secondly, the testbed services are rarely core functions of the provider organization – these are patient care, teaching or research (structural problem).

In the Terva project, a partial solution is provided to solve these fundamental problems (reachability and structural) in the form of an Intermediary Platform. The platform brings together all healthcare testbed services provided in the Southwest Finland and provides tools for finding the most suitable testbed services for the companies. This is a tremendous improvement to the current situation as the companies often spend significant amount of time in researching the testbed services they need. As the companies may not necessarily find the needed services, as they are in practice a combination of different testbed services, the platform is used for combining existing (complementing) services to meet the companies' demands. In other words, the platform will help in finding the best possible testbed service, or it will support the provider organizations in creating new ones.

The intermediary platform also answers to the needs of the service provider organizations. The platform provides a way for creating more mature services that are also of a higher quality. Eventually, this will also lead to better healthcare, as the solutions are more ready to meet the demands of the healthcare professionals. The increased maturity of testbed services, and improved match for the market needs, is also a prerequisite for starting more commercially driven testbed services in the future.

During the project, a service that would in the future act as a gateway to health-related testbed services was developed. The purpose of the service was to aggregate - to bring together- different testbeds, and to help the companies (and other interested parties) to access the entire service portfolio from a single point of access. The service, internally labelled as an "Intermediary Platform" (IP) during the project, had two distinct functions. Firstly, it would hide the unnecessary complexity and labor associated with contacting individual testbeds from the companies. Secondly, it would help the testbed service providers to analyze the initial contact and decide which testbed(s) would be the most suitable for co-development.

The central piece of information that was used in managing entire co-development initiative was a well-formulated and documented need. Instead of using a provided testbed service as a focal point of co-development (e.g. usability testing), the companies were asked to depict what they where they needed help or a partner, and with a series of follow-up questions, the companies were asked to refine their need further. This

two-staged approach (initial need, follow-up questions that were used for refining the need) was used in identifying potential co-development partners, and more importantly, services that could be used for addressing the need.

In this, the testbed services were on regarded as stand-alone or monolith structures, but as flexible parts that could be combined in creating a service assembly that would be more suited to the co-development needs of the company. For example, if the company needed help in developing a product that would be marketed for families with small children, testbed services of the local University Hospital, and those of the municipal children's health clinic could be combined (Fig. 4). With this approach, the effect of the co-development was factored into the testbed services from the first contact onwards.

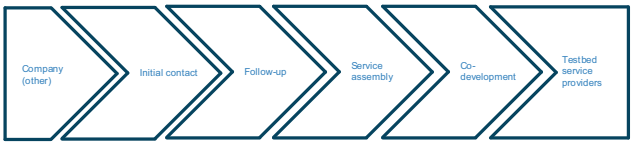

Fig. 4. Service process (IP), simplification

The flexibility and possibility to create testbed service "assemblages" made the IP more than just a digital platform of testbed services in similar fashion to Amazon, Etsy or Uber [17], but more of an intermediary platform that could be used in a) facilitating co-development needs, b) for configuring the interplay and roles of individual testbed services, and c) for brokering different testbed service providers, and companies that need the services, together. Adapting this three-tiered view coined by Stewart and Hyysalo [18] to the role of the IP made the service more akin to a cybercafé (ibid.) than to an electronic marketplace or one-stop-shop to an electronic service portfolio.

This similarity is further highlighted if we investigate the role of the "managers" or actual innovation intermediaries [19] of the IP. While the role of the service in itself was straightforward (manage initial contact, help in formulation a more detailed co-development need and finally address the need), the innovation intermediaries were the individuals responsible for building the service assemblages that would be offered to the companies. This work that was done behind the scenes, face-to-face, was the most important part of the function of the IP.

The intermediaries were gatekeepers for the actual co-development as they were responsible for nurturing the interorganizational and organizational networks of testbeds. This was a challenge as the testbed service providers represented different higher education institutes, health service providers and research organizations – all with different views on co-development, contracts, and related administrative aspects.

4 Conclusions

Based on our conceptual work, we argue that Concurrent Engineering is a viable alternative for bringing together different research and development aspects. However, in the field of healthcare where social, economic and ethical aspects are often intertwined

forming a complex framework for development, a mechanism that brings together different domain testbeds can be of essence. In this an Intermediary Platform, a technological service that acts as a) a single point-of-service to companies with co-development needs, and b) an integrating service channel that brings testbed services and service providers together as a coherent whole, is one way to integrate CE with particulars of healthcare domain. While practical experiences from the IP remain scarce, the integrative approach has already enriched cross-organizational communication and created new needs-based service "assemblages", that are ready to meet the needs of (technology) companies working – or entering – the field of healthcare. With the work already done, the testbed services of South-Western Finland have matured, and taken the next concrete steps towards creating services that more marketable and market-friendly than those available today.

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References

1. Koufteros, X., Vonderembse, M., Doll, W.: Concurrent engineering and its consequences. J. Oper. Manag. **19**, 97–115 (2001)
2. Liu, D.Z., Liu, M., Zhong, P.S.: Method of product development process analysis and re-engineering for concurrent engineering. Mater. Sci. Forum **472**, 770–774 (2004)
3. Sorli, M., Stokic, D.: Innovating in Product/Process Development: Gaining Pace in New Product Development. Springer, Heidelberg (2009)
4. King, J.P., Jewett, W.S.: Robustness Development and Reliability Growth. Pearson Education Inc., Boston (2010)
5. Nahm, Y.E., Ishikawa, H.: A new 3D-CAD system for set-based parametric design. Int. J. Adv. Manuf. Tech. **29**, 137–150 (2006)
6. Michaelis, M.T., Levandowski, C., Johannesson H.: Set-based concurrent engineering for preserving design bandwidth in product and manufacturing system platforms. In: Proceedings of the ASME 2013 International Mechanical Engineering Congress and Exposition, San Diego (2013)
7. Al-Ashaab, A., Golob, M., Attia, U.M., Khan, M., Andino, A., Perez, A., Guzman, P., Onecha, A., Kesavamoorthy, S., Martinez, G., Shehab, E., Parsons, J., Berkes, A., Haque, B., Soril, M., Sopelana, A.: The transformation of product development process into lean environment using set-based concurrent engineering: a case study from an aerospace industry. Concurr. Eng.-Res. A **21**, 268–285 (2013)
8. Hille, J.: State-of-the-art review of lean product development practices and their impact on project success. In: Proceedings of the International Annual Conference of the American Society for Engineering Management, p. 1 (2015)
9. Ward, A., Liker, J.K., Cristiano, J.J., Sobek II, D.K.: The second Toyota paradox: how delaying decisions can make better cars faster. Sloan Manag. Rev. **36**(3), 43 (1995)
10. Raudberget, D.: Practical applications of set-based concurrent engineering in industry. J. Mech. Eng. **56**(11), 685–695 (2010)
11. Sobek, D.K., Ward, A.C., Liker, J.K.: Toyota's principles of set-based concurrent engineering. Sloan Manag. Rev. **40**(2), 67–84 (1999)
12. Loureiro, G., Panades, W.F., Silva, A.: Lessons learned in 20 years of application of systems concurrent engineering to space products. Acta Astronautica **151**, 44–52 (2018)

13. Kayis, B., Arndt, G., Zhou, M., Savci, S., Khoo, Y.B., Rispler, A.: Risk quantification for new product design and development in a concurrent engineering environment. Ann. CIRP **55**(1), 147–150 (2006)
14. Valle, S., Vázquez-Bustelo, D.: Concurrent engineering performance: Incremental versus radical innovation. Int. J. Prod. Econ. **119**, 136–148 (2009)
15. SFS-EN ISO 13845:2016 Medical devices. Quality management systems. Requirements for regulatory purposes (ISO 13485:2016)
16. WHO: Global Atlas of medical devices (2017). https://www.who.int/medical_devices/publications/global_atlas_meddev2017/en/. 31 Jan 2020
17. Kenney, M., Zysman, J.: the rise of the platform economy. Issues Sci. Technol. **32**, 61–69 (2016)
18. Stewart, J., Hyysalo, S.: Intermediaries, users and social learning in technological innovation. Int. J. Innov. Manag. **12**(3), 295–325 (2008)
19. Dalziel, M.: Why do innovation intermediaries exist? In: DRUID Conference, London, UK (2010). https://www.researchgate.net/profile/Margaret_Dalziel/publication/228855626_Why_do_innovation_intermediaries_exist/links/548ed69f0cf225bf66a713bf.pdf. Accessed 29 Jan 2020

Correlations in Time Management and Organizational Commitment

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Abstract. Time is the most important resource for leaders. People's productivity, and hence organizations' performance are heavily related to their time usage. Therefore, especially leaders should have conscious awareness towards their conscious awareness towards time. Employees' commitment and engagement are one of the key contributors to organizational performance and its competitive advantage. It has many positive effects, both for workers and for their organization. Employees who identify to and are committed to their organization are likely to want to exert more effort on its behalf leading to improved productivity, quality, profitability and customer satisfaction. This article presents research of correlations between time management and organizational commitment of leaders in larger organizational change. Phenomena are scrutinized separately from both point of views and as combined. Analysis shows that there are significant correlations in all analyzed point of views. Future research aspects are also issued in this paper.

Keywords: Time management · Leadership · Commitment · Organizational behaviour · HRD · Learning organization

1 Time Personality

Success in knowledge economy comes to those who know themselves, their strengths, their values and how they best perform" [1]. Drucker's statement emphasizes personal skills and self-consciousness in leadership domain "Effective executives do not start with their tasks, they start with their time" [2] shows that the time is always an imperative driver. This driver is a unique resource and one of the most interesting one as well as it is one of the hardest to master or generalize [3]. Hardest part for leadership domain is that we are always lacking it. [1, 4] Therefore to be an effective leader is to learn how to manage one self's own time. Measurement of chronological time duration, speed and numerical order with clocks [5], is not even near to managing it and even farther from understanding it. Conscious awareness towards own time personality and recognition how person experiences the time are should be clear before understanding and managing time can even be discussed [3].

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Time's two faces can be separated to subjective time and objective [6]. Objective time is also named to chronological time and it is a domain where business and management is done. Subjective time is domain leadership and human actions are done [3] Cf. for Czarniawska [7] for the history of Chronos (chronological) and Kairos (human time). Two ancient Greeks gods for time have given their names to these two faces of time. As chronological, objective, time can easily be synchronized with clocks or other specific measurement devices, subjective, Kairos time is relativistic and the speed of it is dependent on many different factors. Personal ways to utilize and sequence time, feeling, [6], cultural background [8], situation, time pressure [9], sleep deprivation [9, 10], personal traits [11] and planning personality [12] are all domains which are biasing experienced time to differ from objective time [3]. Therefore, when scrutinizing peoples' experienced time should be done when the people are as similar situation as possible. Since there are so many variables which are affecting the experienced time [3], some major common matter should be found, such as larger change in organization or long time from any larger changes in organizations environment.

The hectic work situation may cause people the willingness to compress every moment of the day with very intensive activities, cut everything, what feels time waste at that time, and try to get only the essence of things to their mind [4]. Compressive mindset, if it is up kept too long, might end up to situation where person is "implying that rational reduction of information, emotions, and alternatives is necessary to reach organizational and individual goals." This leads to a situation where quality, creativity, open-mindedness, innovativeness, and empathy are reduced [13]. These kinds of situations are quite common in larger changes in organizations or at their environment. Studies show that if the balance is not found between personal life and work, the organization may start to lose their workers. Balance between personal and work life has been found to be the most or the second most important attribute of the job [14] and therefore it is crucial to try to find out if there is relations between time management and organizational commitment. In addition, it's also found that when a person does not receive enough time for rest and sleep, it may lower his or her self-control and it may rise unethical behavior [10] and sleep-deprivation is shown to harm execution of time-pressured activities [9]. All of these could be thought to harmful in larger changes of organization, especially if person has insufficient delegating skills [15] and too optimistic future orientation [12], which may be the case in new positions. Time usage, on the other hand, cannot be mastered, if boss, system (organization), peers, or followers are using all leader's time [15] which also is quite typical when organization is in change.

2 Organizational Commitment

Organizational commitment has been researched for decades when focusing on the performance of individuals and organizations [16–19]. One of the main reasons why the concept of organizational commitment has attracted considerable interest in research is because it has many positive effects, both for workers and for their organizations. Research on organizational commitment focuses to understand the strength and stability of employee dedication to work organizations [20]. Organizational commitment can be defined as a psychological state that binds an individual to an organization [21]

and influences individuals to act in ways that are consistent with the interests of the organization [22, 23]. Rusbult and Farrell [24] used a similar definition of organizational commitment which described it as the willingness to put in extra effort, the desire to remain, and the acceptance of the goals and values of the organization.

According to extensive studies, employees who identify with and are involved in their organization (in other words, are committed) want likely to stay with their organization and utilize effort towards its targets [19, 22]. Studies indicate, that committed people will be, for example, more devoted to their jobs, are more inclined to innovate, and more motivated to use their time and effort to perform their tasks and to help others [25–27]. Subsequently, commitment has been found to have an influence on operational performance and effectiveness, which leads to better productivity, quality, profitability and customer satisfaction e.g. [28, 29]. In this study, we used the conceptualization of organizational commitment from Meyer and Allen [18, 30] as the main model, who describes commitment as a psychological state, which employees experience in three simultaneous mind-sets towards their organization. Their widely recognized three-component model of commitment (TCM) divides the construct into three distinct components which they denominate as 1) affective commitment, 2) normative commitment and 3) continuance commitment [18, 30]. Each type of commitment, which employees can experience simultaneously to varying degrees, affects differently how an employee feels and behaves in the organization for which they work [31]. In short, based on the model, employees feel they want to (affective commitment), need to (continuance commitment), or ought to (normative commitment) remain with their employer. This model tied earlier three separate research views about commitment together and was affected by their strengths and weaknesses [32]. In the ontology classification, we used also conceptualization of organizational engagement which previously was used mainly in human resources consulting [33]. According to Robinson et al. [34], an engaged employee is more aware of the business context of their behaviors and shows the two-way relationship between employer and employee more clearly than job satisfaction, employee commitment or organization citizenship behaviors (OCBs).

3 Research

The research was done by utilizing two assessment systems called Chronos & Kairos (C&K) [35] and Helix [36]. These assessment systems are utilizing ontology engineering, the precision of meaning, and usage of soft-computing methods and fuzzy logic in order to found out what is and how to cope with uncertainty and imprecision in human knowledge inputs [37]. C&K's main purpose is to reveal holistic picture regarding individuals' conscious awareness towards time and to give possibility for thorough research for peoples' differences in it [3]. The Helix application was created to support business organizations in their decision-making and leader-ship [36]. Both systems were developed over many years of research and their construction has evolved many times based on testing. Both assessment systems are developed so that they will give a comparable overview of respondent's current situation and feelings and target situation and desirable feeling. Remarkable of these applications is that respondents' answers to statements so that they could choose any analogic answering scale for these two (current and target)

situations. Scales for answers are for example never, sometimes, usually and always but such as in Likert scale there are no steps and respondent can answer freely i.e. analogically at any point of the scale. This method is called VAS-meter (Visual Analogue Scale), and it is specially developed to describe subjective matters [38].

C&K is constructed so that it includes different (n = 24) features and categories (n = 9). These categories are divided into two main classifications: 1) managing time and 2) experiencing time. These features and categories are consisting 168 statements to be answered. Helix consists (n = 32) individual features, which are grouped into different (n = 10) sub-groups and two main groups. These consists 123 statements. For complete construct of the ontologies of systems, please see [35, 36].

All answers to statements were handled as decimal number variables valued between 0 and 1. Fuzzy logics were used in order to form respondent's linguistic answers to numbers. Fuzzy logic is used in order to process linguistic data in computational, numerical ways. Fuzzy sets are ways to represent vagueness in linguistics [39].

In order to find out whether there are correlations between innovativeness and time, this research's Proposition 1 is: People's needs for development correlates between each other's in a) time management and b) organizational commitment and proposition 2 is: People have similar development needs in time management and commitment.

3.1 Research Data and Analysis

The research data collection was executed in 2018–2019 and consisted of 13 persons. Respondents were directors and managers from Turku University of Applied Sciences (TUAS). Age variety was 39–62 and both genders were presented. From the respondents 54% were females (7 persons) and 38% were males (5 persons). One respondent didn't want to choose from those possibilities. Respondents' answered to statements in situation of larger organizational change. TUAS has just changed the organizational structure in whole university and new organizational structure was commissioned less than month ago during the time of data gathering. Respondents answered to 167 statements in C&K and 123 statements in Helix. Respondents answered twice to each statement, current status and target status. As a result, all respondents answered to 2 times for 168 + 123 statements when they had accomplished both research tools. This gives 7566 different individual variables to research data mass.

The statistical analysis started so that all input data was exported from the Evolute tool to Excel files. All statistical analysis was made in Excel. Creative tension, the main handled variable in this research, is the difference between target status and current status and therefore points out the respondent's direction and amount of the need for the development in different statements' domains. The creative tension was calculated by subtracting the current status variable from the target status variable. Since all answers were quantified from linguistic answers to numbers between −1 and 1 grouping was done so that after the calculation of creative tension for each statement, respondents' answers were analyzed by grouping their creative tensions to 9 different groups and calculating the percentage of answers in each group. This was done, in the sake of comparison since assessment systems possess different amounts of statements. The division could be seen in Fig. 1 where each column pair represent one group. As seen from the Fig. 1 bar chart there is correlation clearly to be seen. Since the sample was quite small, we utilized

Spearman correlation for more detailed analysis. The sample showed good correlation: r = 0,819, p > .001. When analyzing the correlation between respondents' answers from both assessment systems the results were as showed in Table 1.

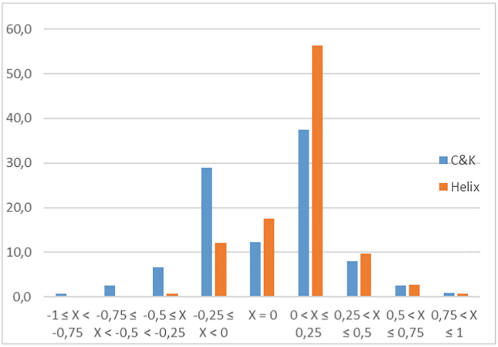

Fig. 1. Division of answers divided to categories

Table 1. Correlations in assessment systems and between them

	p < .001 n	p < .001%	p < .005 n	p < .005%	p > .005 n	p > .005%	Total n	Total %
C&K	59	75.6	5	6.4	14	17.9	78	100
Helix	37	47.4	10	12.8	31	39.7	78	100

As seen from Table 1, 82% of comparisons in C&K and 60.2% in Helix had statistically positive correlation in comparisons. No statistically significant correlations were found in 17.8% in C&K and 39.7% in Helix. In addition, comparisons between both systems were made. Out of 78 comparisons 39 (50%) was correlating significantly in both systems and 8 (10.3%) weren't correlating in either system. From the comparisons, 31 (39.7%) were correlating in either C&K or Helix, but not in other.

4 Conclusions

From the results, it could be seen that in time management people's development needs seem to be very similar. You could almost say that they are identical when the situation is the same. Hence Proposition 1a: People's needs for development correlates between each other's in time management is confirmed. When understanding the background of the situation, in the middle of larger organizational change, when the new organizational structure is recently commissioned, this sounds reasonable but needs to be more scrutinized. People's organizational commitment is not so parallel with each other, but it still seems to be so that the majority of the people feel the same way when looking at the features of commitment. Hence Proposition 1b: People's needs for development correlates between each other's in organization-al development is confirmed.

In addition to these individual observations towards time management and organizational commitment, it seems that development needs combined are very similar. Correlations between people's development needs correlated well and gave high statistical correlation. The results of the comparison of the individuals' development needs correlations in time management and organizational commitment showed that half of comparisons correlated statistically significantly in both and every tenth comparison weren't correlating in either. This also strengthens the evidence for proposition 2. Hence the proposition 2: People have similar development needs in time management and commitment is confirmed.

In order to strengthen these main conclusions more research should be done. Research questions such as: Which statements are mostly correlating between C&K and Helix assessment systems? Which are the main features in time management and organizational commitment that are correlating? Does enhanced time management skills automatically enhance innovativeness or vice versa? To find out more detailed information and to make more deep conclusions, more thorough statistical analysis should be made, and research should be repeated with larger sample group.

References

1. Drucker, P.F.: Managing oneself. Harvard Bus. Rev. **83**, 100–109 (2005)
2. Drucker, P.F.: The Effective Executive. Harper & Row, New York (1967)
3. Reunanen, T.: Human factor in time management. Procedia Manuf. **3**, 709–716 (2015)
4. Turnbull, S.: Perceptions and experience of time-space compression and acceleration. J. Manag. Psychol. **19**(8), 809–824 (2004)
5. Sorli, A.: Time as a stream of change. J. Theor. **4–6** (2002)
6. Harung, H.S.: Reflections: improved time management through human development: achieving most with least expenditure of time. J. Manag. Psychol. **13**(5/6), 406–428 (1998)
7. Czarniawska, B.: On time, space and actions nets. Organization **11**, 773–791 (2004)
8. Lewis, R.: When cultures collide, 3rd edn. WS Bookwell, Helsinki (2010)
9. Kobbeltvedt, T., Brun, W., Laberg, J.C.: Cognitive processes in planning and judgments under sleep deprivation and time pressure. Organ. Behav. Hum. Decis. Process. **98**, 1–14 (2005)
10. Barnes, C.M., Schaubroek, J., Huth, M., Ghumman, S.: Lack of sleep and unethical conduct. Organ. Behav. Hum. Decis. Process. **115**, 169–180 (2011)
11. Berglas, S.: Chronic time abuse. Harvard Bus. Rev. **82**, 90–97 (2004)
12. Buehler, R., Griffin, D.: Planning, personality, and prediction: the role of future focus in optimistic time predictions. Organ. Behav. Hum. Decis. Process. **92**, 80–90 (2003)
13. Sabelis, I.: Hidden causes for unknown losses: time compression management. In: Whipp, R., Adam, B., Sabelis, I. (eds.) Making Time. Oxford University Press, Oxford (2002)
14. Johnson, J.: Flexible working: changing the manager's role. Manag. Decis. **24**(6), 721–737 (2004)
15. Oncken Jr., W., Wass, D.L.: Management time: who's got the monkey? Harvard Bus. Rev. **77**, 178–186 (1999)
16. Mathieu, J.E., Zajac, D.M.: A review and meta-analysis of the antecedents, correlates, and consequences of organizational commitment. Psychol. Bull. **108**(2), 171 (1990)
17. Meyer, J.P., Allen, N.J., Smith, C.A.: Commitment to organizations and occupations: extension and test of a three-component conceptualization. J. Appl. Psychol. **78**(4), 538–551 (1993)

18. Meyer, J.P., Allen, N.J.: A three-component conceptualization of organizational commitment. Hum. Resour. Manag. Rev. **1**(1), 61–89 (1991)
19. Mowday, R.T., Porter, L.W., Steers, R.M.: Employee Organization Linkages: The Psychology of Commitment, Absenteeism, and Turnover, vol. 153. Academic Press, New York (1982)
20. Eisenberger, R., Fasolo, P., Davis-LaMastro, V.: Perceived organizational support and employee diligence, commitment, and innovation. J. Appl. Psychol. **75**(1), 51–59 (1990)
21. Meyer, J.P., Herscovitch, L.: Commitment in the workplace: toward a general model. Hum. Resour. Manag. Rev. **11**(3), 299–326 (2001)
22. Mowday, R.T., Steers, R.M., Porter, L.W.: The measurement of organizational commitment. J. Vocat. Behav. **14**(2), 224–247 (1979)
23. Porter, L.W., Steers, R.M., Mowday, R.T., Boulian, P.V.: Organizational commitment, job satisfaction, and turnover among psychiatric technicians. J. Appl. Psychol. **59**(5), 603 (1974)
24. Rusbult, C.E., Farrell, D.: A longitudinal test of the investment model: the impact on job satisfaction, job commitment, and turnover of variations in rewards, costs, alternatives, and investments. J. Appl. Psychol. **68**(3), 429–438 (1983)
25. De Clercq, D., Rius, I.B.: Organizational commitment in Mexican small and medium-sized firms: the role of work status, organizational climate, and entrepreneurial orientation. J. Small Bus. Manag. **45**(4), 467–490 (2007)
26. Meyer, J.P., Srinivas, E.S., Lal, J.B., Topolnytsky, L.: Employee commitment and support for an organizational change: test of the three component model in two cultures. J. Occup. Organ. Psychol. **80**(2), 185–211 (2007)
27. Ng, T.W., Feldman, D.C., Lam, S.S.: Psychological contract breaches, organizational commitment, and innovation-related behaviors: a latent growth modeling approach. J. Appl. Psychol. **95**(4), 744 (2010)
28. Harter, J.K., Schmidt, F.L., Hayes, T.L.: Business-unit-level relationship between employee satisfaction, employee engagement, and business outcomes: a meta-analysis. J. Appl. Psychol. **87**(2), 268–279 (2002)
29. Wright, P.M., Gardner, T.M., Moynihan, L.M., Allen, M.R.: The relationship between HR practices and firm performance: examining causal order. Pers. Psychol. **58**(2), 409–446 (2005)
30. Meyer, J.P., Allen, N.J.: Commitment in the Workplace: Theory, Research, and Application. Sage, Thousand Oaks (1997)
31. Meyer, J.P., Stanley, D.J., Herscovitch, L., Topolnytsky, L.: Affective, continuance, and normative commitment to the organization: a meta-analysis of antecedents, correlates, and consequences. J. Vocat. Behav. **61**(1), 20–52 (2002)
32. Solinger, O.N., Van Olffen, W., Roe, R.A.: Beyond the three component model of organizational commitment. J. Appl. Psychol. **93**(1), 70 (2008)
33. Macey, W.H., Schneider, B.: The meaning of employee engagement. Ind. Organ. Psychol. **1**(1), 3–30 (2008)
34. Robinson, D., Perryman, S., Hayday, S.: The drivers of employee engagement. Report–Institute for Employment Studies. Institute for Employment Studies (2004)
35. Reunanen, T.: Chronos and Kairos – understanding and managing time. In: Kantola, J. (ed.) Organizational Resource Management – Theories, Methodologies, and Applications. CRC Press, Boca Raton (2015)
36. Einolander, J.: Strategic Assessment of Organizational Commitment. University of Vaasa. Acta Wasaensia 406 (2018)
37. Kantola, J.: Organizational Resource Management: Theories, Methodologies, and Applications. CRC Press, Boca Raton (2015)
38. Aaltola, J., Valli, R.: Ikkunoita tutkimusmetodeihin, 3rd edn. PS-Kustannus, Juva (2010)
39. Lin, C.T., Lee, C.S.G.: Neural Fuzzy Systems - A Neuro-Fuzzy Synergism to Intelligent Systems. Prentice-Hall Inc., Upper Saddle River (1996)

Lack of Authority, Failure of Leadership–Burden of Not Being Led

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Abstract. The purpose of this research is to scrutinize the difference between autocratic leadership and absence of leadership. We utilized simple division between autocratic leader and laissez-faire leader in order to find out how these stereotypical leaders' are affecting the followers. Typically, autocratic leadership is situated to be bad leadership approach and follower's freedom is emphasized. Cognitive constructivism and empowerment of followers are embracing the freedom and followers own responsibility. However, the question for best approach for leadership is too complex to be answered with easy solutions. Real world cases rarely fit to ideal models. In this article, we analyze how these two types of extreme ends in leadership behavior affect the followers' feeling of certainty. We show how these approaches affect to followers by analyzing open answers with a mix method design with both quantitative and qualitative analysis.

Keywords: Leadership · Organizational behavior · Role · Management · NLP · Machine learning

1 Literature

In the early parts of leadership research, the superior characteristic of the behavior is also set to explain leadership as the behavioral theories. The division that Lewin made to authoritarian, democratic and laissez-faire- leadership is probably one of the most recognized. [1, 2] Later, very broad review research showed that leadership styles can be set in to dimension between autocratic-authoritarian and democratic-egalitarian so that it builds up a very consistent factor [3].

The autocratic leader keeps the decision making him/herself and exerts more control over subordinates' behavior and performance than democratic leader. Autocratic leaders also prioritize task completion over human relationships. [3] Classic example from Lewin shoved that autocratic leaders were less cooperative, constructive, cohesive and stable but more aggressive and apathetic than democratic leaders. [1, 4] Dominance is related to autocratic leaders. It also can be related to ability to persuade others this

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skill is not merely enough for successful leadership if technical abilities are lacking [5]. Dominance is related to a more autocratic than egalitarian leadership [6]. Typically, autocratic leadership is identified to style that is not taking care of the team's socio-emotional dimensions such as maintaining group cohesion and promoting the group as a viable social entity [7–9]. When leaders is absent autocratic teams perform badly and are prone to explosive aggression after situations where frustration is pent-up [1]. These teams also suffer from attrition and scapegoating behavior [10] and unhealthy rivalry inside group [1, 10].

Opposite for autocratic leadership is laissez-faire leadership. Laissez-faire leadership is the avoidance or absence of leadership i.e. non-leadership. Laissez faire leaders avoid decision making, are absent and hesitate to take action [11, 12], ignoring problems and subordinate needs, in essence showing indifference about the task and subordinates [13]. Researches shows that laissez-faire leadership is seen ineffective [11, 14] and it is highly dissatisfying for followers [11]. Leaders with laissez-faire profile possess low intelligence, dedication and tyranny, but average sensitivity [15]. Empirical evidence shows that autocratic leaders negatively influence group effectiveness and stability [16]. It is suggested that clarity in the chain of command and authority levels allows team members to have relatively uniform expectations towards roles and behavior [17, 18], which reduces uncertainty [19]. Moreover, even on top to that autocratic leadership has shown to reduce uncertainty in some situations [20].

2 Research

2.1 Initial Sample

At first phase of the research, we gathered the information regarding different experiences of leaders. Gathering was done by exercise included in students' (respondents) leadership and communication courses. At the exercise students task was to analyze their experiences from their work places, or if work experience was lacking, from hobbies, where they have been in their past. We gave a short introduction lesson towards four distinctive and stereotypical leadership characters and how these may be recognized for students. After introduction lesson respondents got task that, they should analyze three different leader from their past and place them under one of certain stereotypical character. Respondents' task was to describe and analyze leaders and reason why they'd position certain leader to certain stereotypical character. This was done by open answers. In the task, we diminished leader characteristics to four distinctively different ones: 1) "One of the team" (OTL), 2) "Autocratic leader", (AL) 3) "Servant leader" and 4) "Leader who has in and out role in team". OTL was representing stereotypic of leader who possesses the official management status, but not charismatic leadership status and who have not taken the leadership responsibility. We chose OTL to represent laissez-faire leadership. AL is the leader whose style is autocratic and represents autocratic leader.

We executed the survey among first and second year students from Turku University of Applied Sciences, Finland at 2015–2017. Respondents were first- and second-year students from Industrial management and engineering degree program and Professional sales degree program. Respondents' age ranged between 19–25 and gender ratios was 38.6% females and 61.4% males. All together 163 students answered the survey and each

completed three cases. Because of some misunderstandings, we rejected the answers from 13 students from the research. Typically, in rejected cases, students were using wrong approaches regarding task. From these 150 students, who executed the task how it was meant, 450 cases were collected. Students answered the survey, correctly each completed three cases. In total 450 cases were collected. 39.3% (177) were females' cases, and 60.7% (273) were males' cases.

2.2 Hypotheses

Based on literature handled in Sect. 1 we created our hypotheses as following. Since laissez-faire leadership is giving minimal efforts and responsibility to work leader position, we have our first hypotheses H1. One of the Team Leader (OTL) positively affects Minimal (MIN). When roles and behavior are not clear minimal efforts are causing uncertainty. From there we have our hypotheses 2. H2. Minimal (MIN) positively affects Uncertainty (UNCER). Being in the team with autocratic or laisse-faire leader seems to be something that is not easy we have our hypotheses 3 and 4. H3 One of the Team Leader negatively affects Easy (EAS) and H4. Authoritarian Leader (AL) negatively affect Easy (EAS). Authoritarian leaders have negative impacts for team atmosphere and there we have next hypotheses. H5. Authoritarian Leader (AL) negatively affect TEAM. According to references there are connections between certainty and authoritarian leader we scrutinized this with two hypotheses. H6. TEAM positively affects Certainty (CER). H7. TEAM negatively mediates the relationship between Authoritarian Leader (AL) and Certainty (CER).

2.3 Model Analysis

We used Structural Equation Modeling (SEM) to test the model's goodness-of-fit [21, 22]. Model fit was estimated using CFI, TLI, RMSEA, NFI, and minimum discrepancy divided by their degrees of freedom (CMIN/DF). Values of CFI and TLI close to.95 or higher are indication of good fit [23], the ratio CMIN/DF should be typically lower than 3 [24]. RMSEA should be .06 or smaller [25]. We employed a mix method design, a combination of strength, integrating qualitative and empirical analysis [26, 27, 38]. For mediation, we used the PROCESS toll, which is widely preferred for testing indirect or mediation effects [28].

2.4 Text Analysis

Organizations' leaders continuously seeks to improve performance and profit using innovative tactics [29], and lead their employees towards the success of companies. Aural expressions and language can provide real-time assessment of a currant investigated state. We follow Eckhaus' [30, 31] methodology, employing a combination of N-gram and Bag of Words (Bow) techniques, for the analysis of leadership characteristic. We employed TEXTIMUS, a text mining and analysis software [32]. TEXTIMUS enables unveiling latent themes in texts, discover hidden meanings that could not have been identified through a first reading, develop variables purely based on texts, and find relationships between them.

First, n-gram frequencies were generated. N-gram refers to a contiguous sequence of n words from a given sequence of text [33]. N-gram is often used in sentiment analysis of texts. Next, we employed BoW [34]. BoW is known as the most common method for the translation of text representation to numerical representation. According to BoW, documents are represented as a collection of words, regardless of order. A group of keywords is explored and weighted according to the frequency of its appearance. We therefore computed the frequency of all the words, and grouped words with the highest frequency employed for the research variables. Similarly, to other studies that employed BoW in leadership and top management content [35–37], the frequencies of each group were summed to the research variables, as follows. Uncertainty (UNCER) - words related to uncertainty, such as maybe, uncertain. Certainty (CER) - words related to certainty, such as certainly, definitely. Minimal (MIN). Easy (EAS), and Team (TEAM). One of Team Leader (OTL), and Authoritarian Leader (AL) are the categories of the cases. That is, each case was manually tagged as to which leader type it is associated. Sine OTL and AL are both types of leaderships, we placed a correlation between them in the model.

3 Results

3.1 Research Results

The correlations, means, and standard deviation values between the research variables are presented in Table 1. Since the two leadership types variables are dichotomous, we used Spearman correlation.

Table 1. Correlation matrix, means, and SD

	UNCER	*CER*	*MIN*	*EAS*	*TEAM*	*OTL*	*AL*
UNCER	–						
CER	.06	–					
MIN	.08	.03	–				
EAS	−.06	.16**	.07	–			
TEAM	.13**	.08	−.09	.02	–		
OTL	.12*	−.11*	.11*	−.02	.03	–	
AL	.02	.03	.05	−.11*	−.10*	−.42***	–
Mean	.62	.74	.21	.35	.80	.25	.35
SD	1.29	1.12	.54	.81	1.41	.43	.48

*p < .05, **p < .01, ***p < .001

The hypothesized model showed a good fit: CMIN/DF = 0.83 (p > .05), CFI = 1, NFI = .0.97, TLI = 1.03, RMSEA = 0. All hypotheses were supported. OTL positively affects MIN (H1) and negatively affects EAS (H3). MIN positively affects UNCER (H2).

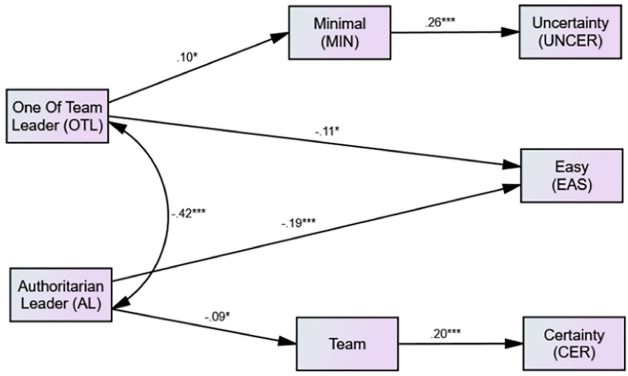

Fig. 1. Model results and standardized coefficients. *p < .05; ***p < .001.

AL negatively affect EAS (H4) and TEAM (H5). TEAM positively affects CER (H6). Figure 1 illustrates the model and results.

From mediation point of view H7, the hypothesis that TEAM mediates the relationship between AL and CER was supported. In the first step, AL shows a statistical significant effect on TEAM ($B = -.28$, $p < .05$). Step 2 showed that the linear regression of AL on CER, a direct effect, was not significant ($p > .05$). Step 3 of the mediation process demonstrated that the mediator (TEAM), controlling for AL, was significant in its effect on CER ($B = .16$, $p < .001$). The bootstrapped Confidence Interval (CI) for the indirect effect ranged from $-.11$ to $-.001$. This result indicates that the indirect effect of the mediator was significant. It was therefore found that TEAM negatively mediates the relationship between AL and CER.

3.2 Conclusions and Discussion

The purpose of this research was to compare autocratic leadership and absence of leadership. Regarding the literature there is quite a lot research done from both and typically, the results are that democratic leadership, where both, the leader and the followers have decision-making power with some ratio is better when compared to either of the extremes. Our results support these. We found significant negative correlation between the autocratic and laissez-faire leaders as expected. We also found that both approaches are setting the followers to uneasy position. Cause for this might be different and it should further researched. Probably the most interesting result from our research was the correlations between leadership approach and certainty/uncertainty. Laissez-faire leadership approach caused uncertainty and it supported former researches. Autocratic leadership approach is negatively correlating with team, which also was supporting former researches. Autocratic leadership produces certainty via negative affect to the team. This result is interesting and deserves further investigation. Our results show that being part of the team is crucial for leader, but leader still should give boundaries and expectations as well as support the team in order to ease uncertainty. Limitations for our research results are remarkable. Our sample group is not representing the working life even when the gender ratio was equal enough. Sample group consisted young people

born after between 1990 and 1998 and were university students. Respondents were only from Finland, Nordic, rich, free and democratic country with long history of equality between all people.

Our results are giving interesting future research suggestions. Can some level of the autocratic leadership approach enhance the performance of the organization and still enhance the team integrity? To which level autocratic leadership behavior should be extended, for boundaries and objectives or to measures and working processes in order to achieve best possible organizational performance? Which kind of follower profiles are suitable for this kind of approach?

References

1. Lewin, K., Lippitt, R., White, R.K.: Patterns of aggressive behavior in experimentally created 'social climates'. J. Soc. Psychol. **10**, 271–299 (1939)
2. White, J.H.R.: Successful supervision. McGraw-Hill, London (1975)
3. Bass, B.M.: Bass' Handbook of Leadership: Theory, Research and Managerial Applications. Free Press, New York (2008)
4. Lewin, K., Lippitt, R.: An experimental approach to the study of autocracy and democracy: a preliminary note. Sociometry **1**, 292–300 (1938)
5. Van Vugt, M.: Evolutionary origins of leadership and followership. Pers. Soc. Psychol. Rev. **10**, 354–371 (2006)
6. Locke, C.C.: Anderson, Cameron the downside of looking like a leader: power, nonverbal confidence, and participative decision-making. J. Exp. Soc. Psychol. **58**, 42–47 (2015)
7. Bass, B.M.: Bass and Stogdill's Handbook of Leadership: Theory, Research and Managerial Applications. Free Press, New York (1990)
8. Cartwright, D., Zander, A.: Group Dynamics. Harper and Row, New York. (1968)
9. Hackman, J.R.: Groups That Work (and Those That Don't). Jossey-Bass, San Francisco (1990)
10. White, R., Lippitt, R.: Autocracy and Democracy: An Experimental Inquiry. Harper Brothers, New York (1960)
11. Avolio, B.J.: Full Leadership Development. Sage, Thousand Oaks (1999)
12. Bass, B.M.: Transformational Leadership: Industry, Military, and Educational Impact. Erlbaum, Mahwah (1998)
13. Yukl, G.A.: Leadership in Organizations, 6th edn. Prentice Hall, Upper Saddle River (2006)
14. Bass, B.M., Avolio, B.J.: Improving Organizational Effectiveness Through Transformational Leadership. Sage, Thousand Oaks (1994)
15. Foti, R.J., Bray, B.C., Thompson, N.J., Allgood, S.F.: Know thy self, know thy leader: contributions of a pattern-oriented approach to examining leader perceptions. Leadersh. Q. **23**, 702–717 (2012)
16. Van Vugt, M., Jepson, S.F., Hart, C.M., De Cremer, D.: Autocratic leadership in social dilemmas: a threat to group stability. J. Exp. Soc. Psychol. **40**, 1–13 (2004)
17. Cooper, W.H., Withey, M.J.: The strong situation hypothesis. Pers. Soci. Psychol. Rev. **13**, 62–72 (2009)
18. Keltner, D., Van Kleef, G.A., Chen, S., Kraus, M.W.: A reciprocal influence model of social power: Emerging principles and lines of inquiry. Adv. Exp. Soc. Psychol. **40**, 151–192 (2008)
19. Magee, J.C., Galinsky, A.D.: Social hierarchy: the self-reinforcing nature of power and status. Acad. Manag. Ann. **2**, 351–398 (2008)
20. Harms, P.D., Wood D., Landay, K., Lester, P.B., Lester, G.V.: Autocratic leaders and authoritarian followers revisited: a review and agenda for the future. Leadersh. Q. **29**, 105–122 (2017)

21. Eckhaus, E.: Happiness in fashion. In: Kantola, J.I., Nazir, S., Barath, T. (eds.) AHFE 2018. AISC, vol. 783, pp. 15–25. Springer, Cham (2019)
22. Eckhaus, E.: How to be Happy. Blog section (2019). www.artistila.com. http://www.artistila.com/how-to-by-happy/
23. Hinz, A., Sander, C., Glaesmer, H., Brähler, E., Zenger, M., Hilbert, A., Kocalevent, R.-D.: Optimism and pessimism in the general population: psychometric properties of the Life Orientation Test (LOT-R). Int. J. Clin. Health Psychol. **17**(2), 161–170. https://doi.org/10.1016/j.ijchp.2017.02.003 (2017)
24. Eckhaus, E., Davidovitch, N.: Potential for blocking advancement: teaching surveys for student evaluation of lecturers. Int. J. Educ. Methodol. **5**(3), 401–406 (2019)
25. Hu, L.T., Bentler, P.M.: Cutoff criteria for fit indexes in covariance structure analysis: conventional criteria versus new alternatives. Struct. Equ. Model. Multidisc. J. **6**(1), 1–55 (1999)
26. Davidovitch, N., Eckhaus, E.: Student evaluation of lecturers – what do faculty members think about the damage caused by teaching surveys? High. Educ. Stud. **9**(3), 12–21 (2019)
27. Eckhaus, E., Davidovitch, N.: How do academic faculty members perceive the effect of teaching surveys completed by students on appointment and promotion processes at academic institutions? A case study. Int. J. High. Educ. **8**(1), 171–180 (2019)
28. MacKinnon, D.P., Fairchild, A.J., Fritz, M.S.: Mediation analysis. Annu. Rev. Psychol. **58**, 593–614 (2007)
29. Eckhaus, E.: Barter trade exchange to the rescue of the tourism and travel industry. J. Shipping Ocean Eng. **1**(2), 133–140 (2011)
30. Eckhaus, E.: Corporate transformational leadership's effect on financial performance. J. Leadersh. Accountability Ethics **13**(1), 90–102 (2016)
31. Eckhaus, E.: A shift in leadership. Acad. Strateg. Manag. J. **16**(1), 19–31 (2017)
32. Eckhaus, E., Ben-Hador, B.: To gossip or not to gossip: reactions to a perceived request to gossip – a qualitative study. Trames. J. Humanit. Soc. Sci. **22**(3), 273–288 (2018). http://dx.doi.org/10.3176/tr.2018.3.04
33. Davidovitch, N., Eckhaus, E.: The influence of birth country on selection of conference destination-employing natural language processing. High. Educ. Stud. **8**(2), 92–96 (2018)
34. Davidovitch, N., Eckhaus, E.: Effect of faculty on research cooperation and publication: employing natural language processing. Econ. Sociol. **11**(4), 173–180 (2018). https://doi.org/10.14254/2071-789x.2018/11-4/11
35. Ben-Hador, B., Eckhaus, E.: The different impact of personal social capital and intra-organizational SC. Int. J. Organ. Theory Behav. **21**(1), 28–47 (2018). http://dx.doi.org/10.1108/IJOTB-03-2018-004
36. Eckhaus, E., Taussig, R., Ben-Hador, B.: The effect of top management team's tacit persuasion on the stock market. e - J. Soc. Behav. Res. Bus. **9**(2), 9–22 (2018)
37. Eckhaus, E., Weber, M., Koppel, M., Spiegel, U.: Inequalities among employees with respect to their contributions and rewards. e-J. Soc. Behav. Res. Bus. **9**(1), 1–9 (2018)
38. Davidovitch, N., Eckhaus, E.: Teaching students to think - faculty recommendations for teaching evaluations employing automated content analysis. Int. J. High. Educ. **8**(3), 83–93 (2019)

A New Operation Model for Property Management Based on Lessons Learned from the Oil and Gas Industry

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Abstract. Integrated Operations (IO) constituted a paradigm shift in offshore oil and gas operations. Access to information from data capture, fiber optics for data transfer, new ways of communication and education of the organizations enabled new and more effective models of operation. The background for this project has been to explore whether the same mechanisms that have proved effective in the oil industry can be reused in operation, maintenance and management of buildings. Special focus has been on how access to and dissemination of available data, analysis and visualization can contribute to more efficient work processes for management, operation, maintenance and development in the organisation. The project has formulated a concept for how this can be operationalized. The paper presents the development framework and the resulting operational concept. Key organizational capabilities identified are presented and explained.

Keywords: Human factors · Macroergonomics · Capability approach · Organizational ergonomics · Work system design

1 Introduction

Digitalization of businesses is going in an increasingly faster pace and across all types of sectors and disciplines. Through its societal mission, a public sector administration company, reporting to the Norwegian government has special responsibility for both digitalization and environmental focus in its own industry. This responsibility should be reflected the company operation model that need to reap the benefits digitalization provides to both utilize resources and expertise more efficiently, get closer to customers and users and help save the environment. In the oil and gas sector, a boost was made to efficient working methods based on digitalization from the early 2000s, through the introduction and continuous improvement of Integrated Operations (IO) [1]. This was a major change across the entire Norwegian continental shelf, and there are many lessons learned from the success stories, but also from measures that did not deliver what one had hoped for and potentials that never came to fruition.

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1.1 Realizing Potential Gains from Building Digitalization

How should work and business processes be adapted, to both individuals and the organization, in order to exploit emerging digitalization opportunities? We here describe the use of a macro ergonomic approach for the development of a new operation model to manage multiple facilities. The property management company is a physically dispersed organization with high demand for exploiting data across different locations and organizational levels. This work has explored how the use of sensors and data analysis can enable planning and management of energy surplus by addressing the organizations development needs. Special focus has been on how access to, and dissemination of, available data, analysis and visualization can contribute to more efficient work processes for management, operation, maintenance and development in the organization. The project has formulated a concept for how this can be operationalized.

1.2 Integrated Operations

In the autumn of 2004, the Norwegian Oil Industry Association decided to implement an industry-wide program. This formed a new self-service concept for remote, real-time management across oil & gas fields on the Norwegian Continental Shelf. This program has constituted a paradigm shift in offshore oil and gas operations, known as Integrated Operations (IO). The core ideas in IO is to:

- Assemble (virtual) groups of people who together hold the right competence for making the good decisions. These people have complementary competence and knowledge, and are usually not situated in the same location
- Collect right time data from the facilities and provide the analytics required for supporting efficient work and data informed decision making

The engineers that were involved in the initial planning of IO might have displayed overconfidence in the effects of the technological possibilities. This created a focus on the technology aspect at the expense of the "softer" people and organization perspectives like collaboration across functions and the way work were performed [2]. To give also the human and organizational dimensions sufficient attention, a joint industry initiative started development of macro ergonomic methodology to enable a more holistic approach based on sociotechnical systems theory. This resulted in the capability approach to IO [3, 4].

2 Method

The project used a qualitative iterative approach in which we performed semi-structured interviews with 10 managers representing the main production areas in the organisation, supplied with input from a series of 4 workshops. The analysis mapped challenges and drivers from the surroundings and assessed these against the status of digitalization work in the organization. The findings were utilized as input to an IO organizational capability development framework [3, 4]. Through this, a set of characteristics that

the organization must develop in order to realize the greatest possible benefit from utilizing new technologies in a future e-business concept were identified. It was further analyzed how the operational context and the operational deliveries would benefit from implementing an IO-inspired operation model.

3 Findings and Discussion

The context analysis and organizational support capability identification steps were following the capability development method for IO [3, 4]. This chapter discusses drivers and opportunities for change, the key principles of a desired new way of working and the main capabilities needed to achieve this.

3.1 Drivers and Opportunities

Areas that the company must develop in order to realize the greatest possible benefit from utilizing new technologies was identified by mapping drivers from the surroundings and assessing this against the status of digitalization work within the organization, as shown in Fig. 1. The aim of this analysis was to identify those aspects of the company's environment that are of the greatest importance for business goals, operations and management.

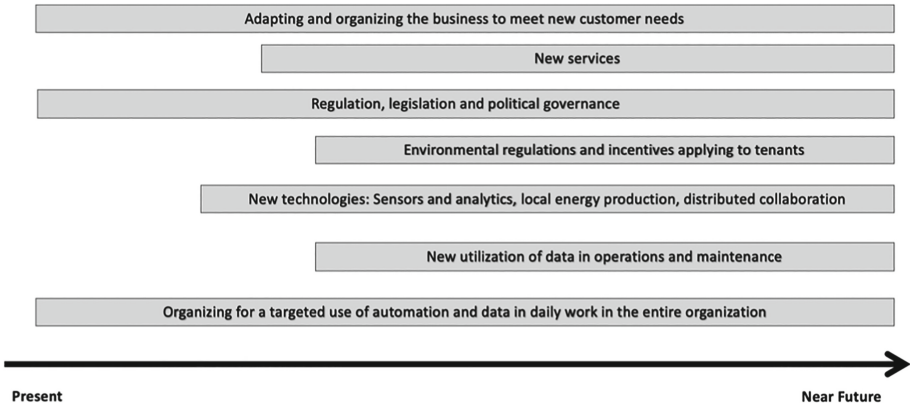

Fig. 1. Identified drivers for change

Furthermore, it was necessary to assess how the company way of working could be adapted to exploit emerging digitalization-driven opportunities as illustrated in Fig. 2.

This was further used as a basis for identifying the capabilities supporting the main services of the organization and which will be key to success in achieving the business goals, given the foreseen changes in the environment.

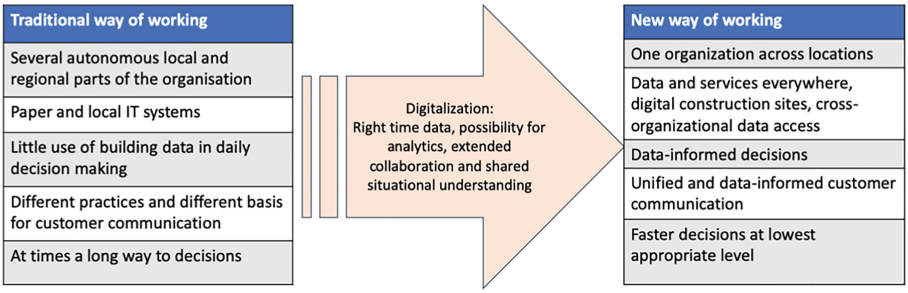

Fig. 2. Change in way of working through utilization of digitalization

3.2 Capabilities Identified as Enablers of Smart Building Operation

Focus for the first stage of capability development was on the enabling capability layer (as shown in Fig. 3). Using the described method, the analysis identified a set of 5 enabling capabilities, of which 2 were further described. These were analytics and collaboration.

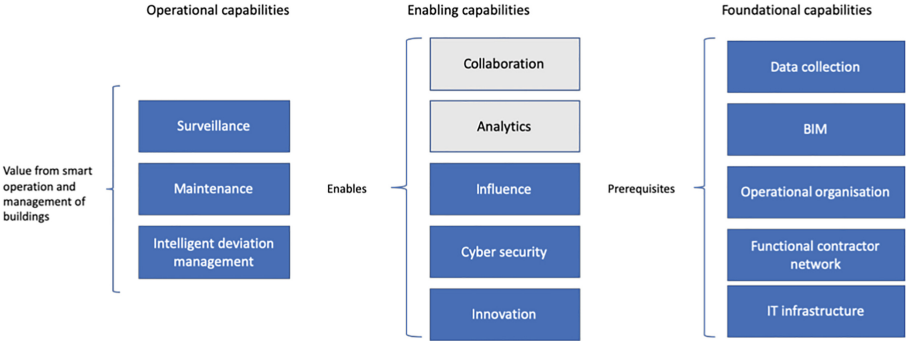

Fig. 3. Operational, enabling and foundational capabilities identified through interview of company managers as important for development of the required new way of working.

The analytics capability is internally oriented in terms of its usage, although it leverages data from multiple and various sources. Its key goal is to enable utilization of data in decision making processes. Furthermore, increased access to data enables greater transparency towards collaborating partners (i.e. service vendors) and better availability of facts in assessments by engineering staff, improving effectiveness and quality of work.

The goals of the collaboration capability are to streamline work processes and resource utilization, and to optimize task allocation. This simplifies access to and utilization of competences independent of organizational and geographical location and ensures utilization of facilities and tools that are suitable for various interaction needs, ranging from simple sharing of a document with a colleague to advanced multipart, video-mediated work meetings with vendors or authorities.

Given that the company develops the required analytics and collaboration capabilities, this will enable a possible transfer of a number of IO work system opportunities.

Extensive use of real-time data from buildings (e.g. condition data, indoor climate, energy consumption and production) can be seen as an equivalent to the oil industry process data gathering and analysis concepts. A well-developed collaboration capability will empower the organization to interact remotely across locations.

The company's geographical spread with buildings across the whole country presents a number of the same challenges that the oil industry has addressed with IO solutions. Developments around sensors and data analysis are very likely to be the same as the process industry has undergone over the past decade. However, there are a number of environmental factors that influence the requirements to an IO – based operation model [2, 5, 6]. A major difference lies in the complexities surrounding geography, planning and logistics. Coupled with the high salary levels and the need for security and preparedness, this means that the costs associated with daily operations and maintenance in offshore oil and gas are not comparable with most other industries. Since the cost of having personnel on the installations is so high, the companies on the Norwegian continental shelf have invested a great deal in facilitating remote operation, collaboration solutions and ways of organizing that allow for more work to be done without being physically present. Land based operations gives higher flexibility in allocation of functions between onshore and offshore.

The offshore oil industry has spent large resources to implement land-based support centers. One believed 10–15 years ago that it was possible to establish common "help desk" solutions that could provide technical support across fields with very different technologies and production processes. It quickly became apparent that such centrally located general problem solvers were unable to provide the detailed support the various fields demanded. Based on this, more functions in the property management company can be placed locally. The nature of work allows for more specialization between different regions and locations and especially more delegation down to the on-site personnel. However, this is not relevant for all types of work. Tasks that require special expertise should as far as data access and communications allow be centralized in the organization. These specialist resources should be organized in way that makes them available to advise different locations without the need to be physically present, i.e. on the team or main office level shown in Fig. 4.

Data from buildings can be collected digitally, both from vendor equipment and from installed sensors. Furthermore, additional (observed or analogue) data can be added to the computer-aided facility management (CAFM) systems by onsite personnel. As shown in Fig. 4, the collective amount of data from the building portfolio can then be included in the organizations store of raw data, and be utilized for producing trends and prognostics to support both local (operational) and central (strategic) decision making. Since data will be utilized differently in the short operational time loops and the longer strategical time loops, it is also essential that information can be retrieved and visualized in a variety of manners and support the range of different purposes and user groups.

4 Conclusion

This project has used a holistic structured macro ergonomic approach with methods adapted from the offshore oil industry in a case of digitalization of a national property

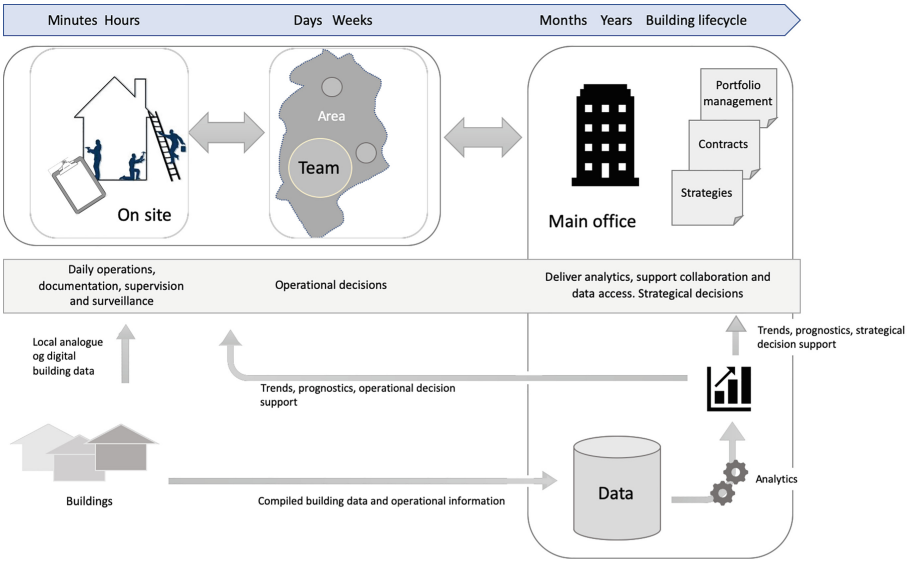

Fig. 4. Overview model of work flow and data management adapted from the Van den Berg [5]

management organization. This approach embraces the entire organization and directly addresses the value chain's work processes.

The method used allows for a structured definition of the traits the organization must possess to succeed with a new work system. Using the capability approach [3, 4] to describe these characteristics required for an IO operation model for building portfolio management allowed for a comprehensive evaluation across the layers in the capability stack including both human, organizational and technological requirements required for a successful operation model.

In comparing the two businesses' potentials for achieving added value through digitalization it was found that though these businesses are in themselves in many ways disparate, enough similarities exist in order to make it viable to apply operation model principles from the offshore oil industry for the development of future operation of property management. Furthermore, the key capabilities identified for further development in the company, collaboration and analytics, are also cornerstones in integrated operations. Given that the company develops these, this will enable a possible transfer of a number of IO work system opportunities.

References

1. Norwegian Oil Industry Association (OLF): Integrated Work Processes: Future work processes on the NCS (2005)
2. Gilman, H., Lilleng, T., Nordtvedt, J.E., Unneland, T.: How Do We Accelerate Uptake and Fulfill the Value Potential of Intelligent Energy? Society of Petroleum Engineers, 6 September 2016. https://doi.org/10.2118/181091-MS

3. Henderson, J., Hepsø, V., Mydland, Ø.: What is a capability platform approach to integrated operations? An introduction to key concepts. In: Rosendahl, T., Hepsø, V. (eds.) Integrated Operations in the Oil and Gas Industry: Sustainability and Capability Development (PE, IGC) (2012)
4. Reegård, K., Drøivoldsmo, A., Rindahl, G., Fernandes, A.: The Capability Approach to Integrated Operations Handbook. Center for Integrated Operations in the Petroleum Industry, Trondheim (2014)
5. Van den Berg, F.G., McCallum, G.A.R., Wallace, S.: Collaborative Working in Shell - Value Achieved, More to Follow. Society of Petroleum Engineers, 15 September 2015. https://doi.org/10.2118/176787-MS
6. Kaland, T., Nordtvedt, J.E., Seim, O.: How Can Integrated Operation Contribute to Improve the Efficiency on the Norwegian Continental Shelf? Society of Petroleum Engineers, 20 April 2016. https://doi.org/10.2118/180014-MS

Digital Disruption in Retail: Management Strategies for South African Shopping Centers

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Abstract. Online retail has grown substantially over the years both globally and in South Africa. Technology continues to impact, influence and shape how and where consumers shop. The South African shopping Centre industry is the 5th largest in the world and houses South African retailers who account for over R900 Billion ($61 Billion) sales revenue or 15% of the GDP.

This report investigated digital disruption in retailing, its impact on the South African Shopping Centre industry and the available strategies that may be employed to counteract any negative impacts. A desktop literature survey followed by qualitative analysis was employed in carrying out the research.

The research found that digital disruption was causing a change in consumer behaviour that leads to a reduction in demand for retail space and lower rentals and retail property values. Available strategies to counteract these negative impacts were found to include a customer centric retail property business model, Shoppertainment, leveraging technology, repurposing shopping centers for other uses, developing green shopping centers and agile property management.

Keywords: Digital disruption · Shoppertainment · Management · Omni-channel · Online-shopping · Customer behaviour

1 Introduction

Online retail has grown substantially over the years both globally and in South Africa. According to a research conducted by Euromonitor research (2018), e-commerce has been the fastest-growing retail channel since 2008 in the USA and it is expected to become the largest retail channel in the country by 2020. The increasing market share of e-commerce has resulted in mall closures and increased vacancies in the USA, a phenomenon that Yan (2018), describes as the "death of the mall". The traditional mall culture of going to malls for shopping and socializing has been disrupted by the arrival of

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ubiquitous Digital Retail Technology or Retailtech. Retailtech enables digital shopping and shopping insights.

In South Africa shoppers still prefer to touch and feel products and thus use a mixture of online shopping and in-store shopping depending on the category of goods and the cost thereof (Prinsloo 2016).

Online shopping is, however, likely to grow over the medium to long-term as we get deeper into the digital era. The use of digital technology in retail will definitely increase as the use of digital equipment such as Smartphones proliferates unabated (McKenzie 2018). Furthermore, online shopping will increase as the heavy technology using Millennials who are the largest segment of the South African population grow older and become the largest proportion of the age groups between 20 and 40 years (Prinsloo 2016).

In response to the observed "mixed shopping" trend, South African online retailers have been joined in the online market by traditional retailers who are setting up online platforms to enable shoppers to do both online and offline shopping. Other online shopping trends that are increasing in occurrence are:

- The online location of stores, where shoppers find store locations online.
- Price and product comparisons.
- Online purchase followed by pick up/collection in-store.
- Online search and product selection followed by product trial in-store and purchase in-store or online (Showrooming).

The research problem that needs to be answered is, therefore "what can the South African shopping centre industry do to meet the challenges posed by the digital disruption of traditional bricks and mortar retailing?"

2 Literature Review

The South African Shopping Centre Industry represents 65% of the retail sales, which exceeded R1 trillion for the first time in 2017. To put these facts in perspective, South Africa has more shopping centers than the rest of Africa combined and has the fifth-largest number of centers in the world. What the foregoing means is that the shopping centre industry is a significant part of the South African economy and way of life (Prinsloo 2018).

In the 20 years between 1998 and 2018, the number of shopping centers has continued to increase resulting in extreme competition. This level of competition coupled with a lack of innovation in marketing such as the low use of social media and the sluggish South African economic growth over the last decade, has resulted in declining weekly visits for all classes of shopping centers (Prinsloo 2018).

The key challenges to shopping centres caused by digital disruption, of which online shopping is just one segment are: Changing consumer behaviour, customers increased experience expectations- mall visits for experiences as opposed to purchasing, customer demand for better transaction efficiency, increased retail price competition, increased channels of delivery by retailers in addition to physical store locations, reduced retailer

floor spaces and demand for space, customer data collection and data-informed marketing, online web presence and social media marketing and interaction and the need for investment in Omni and multi-channel infrastructure (Veuger 2018; PayPal Ipsos 2018; Buss 1997; Changsu 2007; Xin 2017; Marston 2002; Prinsloo 2015).

The key impacts of the challenges posed by digital disruption as observed in the literature are: Decreased demand for space and thus increased vacancy rates, lower rent levels and decreasing income, lower returns on investment for investors in retail property, lease ambiguity on Omni-Channel retailing, increased innovation and investment in technology, obsolescence of certain retailers and shop closures, declining retail property values and flight of capital from retail property sector to other property sectors and vacant retail properties needing repurposing or demolition (Marston 2002; Prinsloo 2016; Baen 2000; Goldman Sachs 2019; Deloitte 2016; Bahru 2014; Rietbergen 2007; McClatchey 2007; Forbes 2019; Retail Leader 2019; Huffington Post 2017; Businesslive 2019).

The strategies that can be adopted by the shopping centre industry are: Enhance the customer experience, customer-centric retail property business model, shoppertainment, leveraging technology, repurposing shopping centres for other uses, developing green shopping centres and agile property management (Guimarães 2019; Buss 1997; Hiltzik 2011; Zhu and Nakata Zhu and Nakata 2007; Rawat 2016; Jukna 2018; Ghermazian 2018; Sachdeva and Goel 2016; O'Roarty and Billingsley 2016; Epstein and Deng 2019; Forsey 2019; BCX 2016; SA Commercial Prop News 2019; Savills 2018; Cloete 2016).

3 Research Method

The research method adopted was a qualitative study that seeks to answer the research problem and sub-problems by means of a desktop literature survey. The survey of the literature was used to come up with a body of knowledge relating to the research problem. The corpus was used to answer the research problem and test the hypothesis. This data was then critically analysed and findings were expressed in the results of the research (Popay 2006).

4 Data Analysis and Findings

The research findings are summarized in Table 1 below. The first column in Table 1 depicts the relationship between the challenges, their impacts and possible strategies to counteract them as derived from the international literature. The challenges are grouped together according to the following rows:

- Row 1 - Customer Behaviour
- Row 2 - Retail Competition
- Row 3 - Omni-channel Retailing
- Row 4 - Vacancy and Lower demand for Space
- Row 5 - Adapting to Technology

Table 1. Cross-sectional analysis - challenges, impacts and strategies

Challenges imposed by digital disruption	Impacts of digital disruption	Strategies that can be adopted
Changing consumer behaviour Customer increased experience expectations - (mall visits for experiences as opposed to purchasing) Customer demand for better transaction efficiency	Decreased demand for space and thus increased vacancy rates Increased innovation and technological capital and operating expenditures	Customer-centric retail property business model Enhance the customer experience
Increased retail price competition	Totally vacant retail properties needing repurposing or demolition	Repurposing shopping centre for other use
Increased channels of delivery by retailers in addition to physical store locations	Lease ambiguity on Omni-channels	Agile property management Flexible leasing
Reduced retailer floor spaces and demand for space	Lower rent levels and decreasing income	Shoppertainment Repurposing excess retail space
Online web presence and social media marketing and interaction Need for investment in Omni and multi-channel infrastructure	Declining Retail property values and flight of capital from retail property sector to other property sectors	Leveraging technology
		Developing green shopping centres

Each of the 5 rows has a unique but often overlapping and compounding impact on the retail property as depicted in the second column. The third column proposes possible strategies to counteract the negative impacts of each challenge.

According to Loos (2019), the current biggest challenge to the South African retail property industry is the eroding of disposable income of the consumer because of the stagnating economy. Online retail and retail space affordability are notable challenges, which will pose a greater threat in the long-term, but the greatest challenge in the short term is the financial condition of the consumer.

5 Conclusion

The South African retail property industry is the largest in Africa and numbered in the world's top 10 for the greatest number of shopping centres. It houses a trillion-rand retail industry which is a major contributor to GDP and employment. The advent of the 4IR has resulted in the development of new technologies in property and retail known as Proptech and Retailtech respectively. These technologies present challenges to the profitability of retailers and in turn the retail properties that house them. The combined effect of these challenges brings both opportunities and negative impacts (threats) to the retail property industry. Strategies can be adopted to minimise the negative impacts and turn some challenges into opportunities as illustrated in Table 1 above.

References

Yan, X.: The Impact of Online Shopping on Shopping Malls. Buffalo State College of the State University of New York, New York (2018)
Prinsloo, D.B.: Online vs. In-Store Shopping. South African Council of Shopping Centres, Johannesburg (2016)
McKenzie, B., Burt, S., Dukeov, I.: Introduction to the special issue: technology in retailing. Baltic J. Manag. **13**(2), 146–151 (2018)
Prinsloo, D.C.: SA Shopping Centre Benchmarks 1998–2018. South African Council of Shopping Centres, Johannesburg (2018)
Veuger, J.: Trust in a viable real estate economy with disruption and blockchain. Facilities **36**(1), 103–120 (2018)
PayPal Ipsos: PayPal Cross-Border Consumer Research 2018. Ipsos PayPal Insights, San Jose (2018)
Buss, D.D.: Entertailing. Nation's Bus. **85**(12), 12 (1997)
Changsu, K., Galliers, R.D., Yang, K.H., Kim, J.: Evolution of web-based shopping systems: characteristics & strategies. J. Electron. Commer. Organ. **5**(4), 70–87 (2007)
Xin, S., Rongzzhi, G., Guanjie, H., Dongmin, C.: Interaction data detection system to upgrade brick and mortar shops. IEEE Consum. Electron. Mag. 57–63 (2017)
Marston, T.D.: The impact of e-commerce on retail real estate in the UK. J. Real Estate Portf. Manag. **8**(2), 153 (2002)
Prinsloo, D.A.: Omni-Channel Retailing Changes, Trends & Strategies. South African Council of Shopping Centres, Johannesburg (2015)
Baen, J.S.: The effects of technology on retail sales, commercial property values and percentage rents. J. Real Estate Portf. Manag. **6**(2), 185 (2000)
Goldman Sachs: How is Tech Reshaping the City Skyline (Podcast Interview). Goldman Sachs, London (2019)
Deloitte Touche Tohmatsu: Technology in Retail: From Centre Stage to Supporting Player. Deloitte, Sydney (2016)
Bahru, J., Rahman, R.A., Adnan, Y.M., Azlina, M.: The impact of information communication technology on retail property in Malaysia. Prop. Manag. **32**(3), 193–212 (2014)
Rietbergen, J.W., Weltevreden, J., Van, T.: E-shopping versus city centre shopping: the role of perceived city centre attractiveness. Tijdschrift voor Economische en Sociale Geografie **98**(1), 68–85 (2007)
McClatchey, J., Cattell, K., Michell, K.: The impact of online retail grocery shopping on retail space: a Cape Town case study. Facilities **25**(3/4), 115–126 (2007)
Forbes (2019). www.forbes.com. https://www.forbes.com/sites/andriacheng/2019/01/20/six-key-retail-tech-trends-to-watch-for-2019-and-its-not-just-about-amazon/#14ccc29666fc. Accessed 25 June 2019
Retail Leader (2019). www.retaileader.com. https://retailleader.com/2019-outlook-retail-tech-innovation. Accessed 25 June 2019
Huffington Post (2017). www.huffpost.com. https://www.huffpost.com/entry/retail-tech-is-changing-how-we-shop_b_59370a14e4b06bff911d7b8c. Accessed 25 June 2019
Businesslive (2019). www.businesslive.co.za. https://www.businesslive.co.za/fm/money-and-investing/2019-03-07-how-mall-owners-can-beat-the-retail-blues/. Accessed 25 June 2019
Guimarães, P.P.C.: Shopping centres in decline: analysis of demalling in Lisbon. Cities **87**(2019), 21–29 (2019)
Zhu, Z., Nakata, C.: Re-examining the link between customer orientation and business performance: the role of information systems. J. Mark. Theory Pract. **15**(3), 178–203 (2007)

Jukna, L.: Dead or destination? Shopping malls in the 21st century (2018). https://www.livingmap.com/smart-building/shopping-malls-in-the-21st-century/. Accessed 28 June 2019

Sachdeva, I., Goel, S.: Experiential retailing: entertainment through shopping. Adv. Econ. Bus. Manag. **3**(1), 16–22 (2016)

SA Commercial Property News (2019). www.sacommercialpropnews.co.za. http://www.sacommercialpropnews.co.za/global-property-news/9003-how-advanced-data-analystics-is-boosting-shopping-centre-performance.htmll. Accessed 02 Aug 2019

Savills Commercial Research: Spotlight: Retail Revolutions 2018 Outlook. Savills, London (2018)

Popay, J., Roberts, H., Sowden, A., Peltcrew, M., Aral, L., Rodgers, M., Britten, N., Roen, K., Duffy, S.: Guidance on the conduct of narrative synthesis in systematic reviews: a product from the ESRC methods programme (2006). http://www.lancs.ac.uk/shm/research/nssr/research/dissemination/publications.php. Accessed 5 July 2019

Loos, J.: FNB Property Insights: Retail Properties Big Consumer Challenge. FNB, Johannesburg (2019)

Research and Practice of Brand Design Method of Local Specialty Products in Developing Regions Under the Concept of Service Design

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Abstract. In recent years, with the rapid development of China's economy, cultural and creative industries have gradually become an important part of the economic growth of China's developing regions. Many enterprises in developing regions urgently need to transform and upgrade from OEM, ODM to OBM, also systematic brand design and transformation strategies. The effective excavation and utilization of the rich characteristic cultural resources in the developing areas will further promote the local economic growth and improve people's quality of life. Service design, as a system design to coordinate the relationship among people, things, behaviors, environment and society, can help the developing regions to find their social and cultural values.

This paper will take Songxi County, Fujian Province, China as an example, through analyzing the problems and bottlenecks in the development of local industries and enterprises, mining local cultural resources, understanding the needs of local residents, using the method of service design to explore and practice the design method of regional characteristic product brand system, constructing the "Integration-Connection-Transformation Mode" of regional characteristic product brand, and achieving the two-way circulation of resources between developing and developed regions through design can realize the redesign and brand innovation of local characteristic cultural products, and ultimately promote economic growth and cultural communication. This research is an effective practice and exploration for the service design method to enhance the regional product brand design, which will play a demonstration role in disseminating regional culture, boosting the developing region's economy and promoting social innovation.

Keywords: Service design · Developing regions · Local specialty products · Brand design · Design methods

1 Brand Status of Developing Regions' Characteristic Products

Since the reform and opening up, China has made great economic achievements and the industrial system construction is basically completed. However, after a stage of rapid growth, China's economy needs to turn to a stage of high-quality development.

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China's social economy urgently needs to improve its sustainable development momentum and stability through organizational innovation, marketing, business model and product R&D. With the transformation of industrial structure from "industrial economy" to "service economy" [1], developing regions can use their own characteristic resources, traditional culture and product manufacturing capabilities to build excellent regional characteristic brands. In order to achieve this, they need to have the right system Unified innovation services, and service design can achieve this well.

1.1 Many Developing Regions Have Excellent Traditional Culture and Characteristic Industrial Resources

Jingdezhen porcelain, as China's "national geographical indication product" [2], has enjoyed a high reputation all over the world since ancient times. Jingdezhen's factory has a high level of porcelain making technology and has a unique porcelain culture in a long history of porcelain making.

In 2013, Wuzhen held the first "Wuzhen Drama Festival", which has developed well in recent years and gained strong brand influence and communication power. In 2014, Wuzhen held the world Internet Conference and became the permanent site of the conference. These two events have greatly helped Wuzhen to publicize its urban cultural image, expand its cultural function [3], and establish a unique cultural brand of Wuzhen.

In fact, many areas in China have a long history and culture, but for various reasons, there is no timely transformation in the process of national economic development, so the economy gradually lags behind the developed areas. If we can make good use of the cultural and industrial resources with regional characteristics, many areas have great development potential.

1.2 Developing Regions Lack of System Innovation Capacity

Songxi County, located in Fujian Province, is a county for poverty alleviation and development at the provincial level before June 2019. Local characteristic resources are rich, including Jiulong Kiln Ceramics, Zhanlu sword and other historical cultures originated in the Tang and Song dynasties The heritage also has regional characteristic agricultural products resources such as Songxi green tea and century old sugarcane. However, resources must be combined with system innovation for better design, display and dissemination, which is the capacity that Songxi and most developing regions lack.

The basic principle of <Design the three-year action plan for Poverty Alleviation (2018–2020)> issued by the Ministry of industry and information technology of China is to provide personalized design assistance services according to local conditions [4]. This coincides with the vision of this study.

1.3 Service Design can Well Build Product Brand and Guide Product Innovation

As a design method that can promote common innovation, service design can coordinate multiple stakeholders, and realize system innovation of service provision, process and contact centering on personnel, environment, facilities, information and other elements with user as the center [5].

2 Research on the Brand Design Method of Developing Regional Products Based on the Concept of Service Design

2.1 Service Design and Developing Regional Characteristic Product Brands

Birgit Mager, global president of the international service design alliance, believes that service design is a more efficient, useful, effective and satisfactory design method that can transform soft services [6].

Elaine Aylward's research can provide some help for the southeast rural communities to provide competitive advantage by identifying rural stakeholders and understanding the obstacles and promoters of regional cooperation [7]. Researcher Xiaowen Chen pointed out that building regional brand and enterprise brand not only requires the learning, innovation, competition and cooperation of the enterprise itself, but also requires the government and Industry Association to provide product, technology, market and other information to the local industrial cluster [8].

Service design is systematic and strategic, which can give full play to the initiative of behavioral logic to promote the interaction of the whole ecosystem [9]. Therefore, not only enterprises are using service design to create business value, but also government agencies are using service design to design public services.

In 2014, the UK government established the policy lab. They try new ways of working and test the feasibility of the way of working. If the test is successful, it will promote the implementation of this innovative way of working in the whole government department [10].

2.2 Research on the Brand Design Method of Developing Regional Products Based on the Concept of Service Design

The specific method of brand design for developing regional characteristic products proposed in this study is "integration connection transformation", which is divided into three parts:

1) Integration: the design team enters the local area for observation records, and organizes the establishment of a co creation team composed of government personnel, enterprises, people and design teams (cross departmental professionals).
2) Connection: connect the design team with the developing region, and the co creation team puts forward a strategic plan suitable for the local development through the cooperation and research of service design related tools.
3) Transformation: use innovative design to transform resource advantages, and implement solutions to promote the brand promotion of featured products, and further promote economic development (Fig. 1).

3 Research on the Brand Design Method of Developing Regional Products Based on the Concept of Service Design

3.1 Practice Process

This study originated from the project of "Design for Country" initiated by the school of art design and media, East China University of Science and Technology. After the

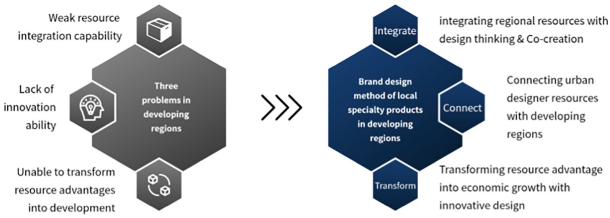

Fig. 1. Brand design method of local specialty products in developing regions

team arrived at the local place, we firstly made an in-depth observation on the local environment, people, behavior and local products.

We found that there is a kind of sugarcane only planted in Songxi with a history of more than 100 years. In addition, Songxi also has local characteristic green tea and registered the geographical logo trademark, which is exactly what we hope to find. Therefore, we decided to carry out systematic innovation of the whole brand with "Century old cane" and Songxi green tea as the core product.

Through communication and thinking sharing with local departments, and striving to find common interests, we have established a co-creation team composed of government personnel, enterprises, people and design teams (cross departmental professionals). Then through the cooperation and research of service design related tools, the solution of local brand building is proposed. Finally, the implementation of the plan will be promoted and transformed into local brand building and promotion.

3.1.1 Users Research

First of all, we found that the main users of this project are people willing to pay for local products and culture, so we will do relevant research on their behavior and experience.

For tourists and consumers, through the design and promotion of the whole Songxi rural innovation complex, people who have never known Songxi gradually begin to understand and like the place with profound cultural background and enjoy better products and services with Songxi brand as the core.

Secondly, for the long-term development of local brands, the introduction of innovative talents is also an important work. We hope that in this project, we can help Songxi to introduce innovative talents and realize long-term brand operation (Fig. 2).

Thirdly, the implementation of the scheme in the project needs the cooperation of local enterprises, so the business interests and social benefits of the enterprise also need to be taken into account. Then, local government departments can promote social innovation and city brand operation through this project, so their activities will also be considered. Finally, as the long-term beneficiaries of the whole service system, local farmers and residents also need to consider their behavior and psychology to design the whole system. Therefore, stakeholder research is necessary for us and will be of great guiding significance for our project (Fig. 3).

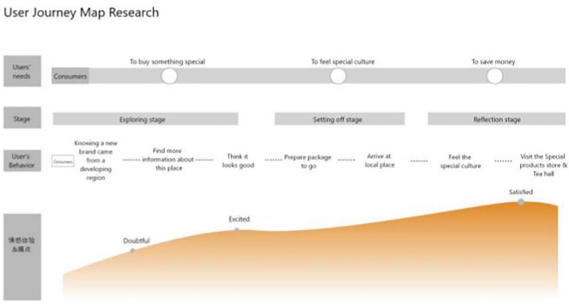

Fig. 2. User journey map of the consumers

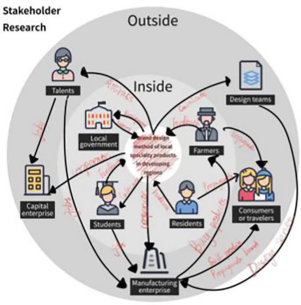

Fig. 3. Stakeholders research

3.1.2 Service System Construction

Through the analysis of local resources and the introduction of external resources, we have integrated all resources that can help the development of Songxi to build a featured product brand service system. Through the Songxi tea hall, the two local characteristic products are put into it for sale, and unique cultural and creative products are created according to the local cultural resources, which together constitute the characteristic product brand of Songxi (Fig. 4).

Fig. 4. Service blueprint of local specialty products brand system

3.2 Achievements

After the strategy was formulated, we launched local social innovation activities, including meetings, forums, design competitions and product projects cooperated with local enterprises. Through the resource coordination of stakeholders, we have finally achieved common innovation.

We decided to take "Millennium Songxi Century Sugarcane" as the propaganda slogan of its regional characteristic product - sugarcane, and build a regional product brand around this slogan. Corresponding to the physical stores, we have built the online "Millennium Songxi Century Sugarcane" flagship store, and carried out publicity and promotion with the help of new Internet media.

3.3 Evaluations

After the project started one year, the sales of several major characteristic brands in Songxi have increased in varying degrees, and the growth of disposable income of farmers has exceeded the growth from 2016 to 2017. The brand value of "Millennium Songxi Century Sugarcane" reached 300 million yuan, the sales increased by 20%; the sales of Songxi green tea increased by 41%. Songxi County in the economic ranking of county-level cities in Fujian Province has also risen from the last to the countdown third.

In the course of the project, Xianjin Yang, then vice governor of Fujian Province, wrote to ECUST students in a letter: "thank you for your contribution to poverty alleviation in your hometown. I hope more and more young students will join in". In June 2019, Songxi officially broke away from the poverty-stricken county status under Chinese standards.

4 Discussion

According to the results of the practice in Songxi, we have verified the feasibility of the brand design mode, such as the strategy of connecting urban designer talents with developing regions. For example, the idea of helping enterprises establish their own product service system can not only help them establish their own brand, but also help them master the initiative of innovation and develop the established brand and culture.

But we also found many problems in the process of project:

1) The designer's works are often unable to be put into production because they can't meet the needs of manufacturers. The main reason is that most of the designers participating in the project are students or young designers who lack market design experience.
2) The economic benefits created by the project are far from the real successful market design, which may be due to the strong social design attribute of the project.

5 Conclusion

Based on the discussion of this research and project practice, we come to the conclusion that the brand design method of the developing regional characteristic products is very

helpful to help the developing region to establish the product brand with regional characteristics, but in the specific practice, we need to pay attention to the balance of the social and commercial nature of the project, realize the commercial value while realizing the social benefits for the enterprise Individual increases income.

References

1. Wang, G.: Service Design and Innovation. China Architecture and Building Press, Beijing (2016)
2. Jingdezhen porcelain. http://www.cgi.gov.cn/Products/Detail/1373/
3. Han, S.: Brand development and urban culture of Wuzhen drama festival. J. Drama Art **03**, 143–153 (2019)
4. Design the three-year action plan for Poverty Alleviation (2018–2020). http://www.miit.gov.cn/n1146295/n1652858/n1652930/n4509650/c6404659/content.html
5. Han, T.: Establish a system to drive social innovation and resources through design thinking. J. Des. **32**(18), 34–39 (2019)
6. Mager, B., Sung, T.J.D.: Special issue editorial: designing for services. J. Int. J. Des. **5**(2), 1–3 (2011)
7. Aylward, E., Kelliher, F.: Rural tourism development: proposing an integrated model of rural stakeholder network relationships. In: IAM Conference, 02–4 September 2009, Galway Mayo Institute of Technology, September 2009
8. Chen, X.: Brand strategy of industrial cluster: building regional brand and enterprise brand. J. Ind. Technol. Econ. **09**, 12–14 (2006)
9. Xin, X., Cao, Z.: Service design drives public affairs management and organizational innovation. J. Des. **05**, 124–128 (2004)
10. Huang, W.: Revolution Driven by Service Design. Mechanical Industry Press, Beijing (2019)
11. Directory of key development areas of service outsourcing industry. http://images.mofcom.gov.cn/fms/201901/20190110104129703.pdf

"Millennipreneurship" vs Entrepreneurship: Exploring Emerging Dynamics in Entrepreneurial Competencies Among Generational Cohorts

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Abstract. As part of the ongoing debate on ideal entrepreneurial competencies, this study seeks to introduce a generational dimension that explores how the generation an individual belongs to could be influential in determining their entrepreneurial competence. In its submission, this paper critically discusses the unique attributes of millennials in on how distinct they are in terms of personality traits from older generations (Baby Boomers and Generation X). The study reviews the literature on entrepreneurial competencies to map them to the personalities of various generational cohorts. The study then makes propositions as to why millennials possess unique entrepreneurial competencies that make them superior entrepreneurs than their predecessors. The findings of this study have significant implications for future research and practice as it offers a more defined basis for examining the competencies of entrepreneurs.

Keywords: Millennials · Entrepreneur · Competencies · Generational cohorts · Baby Boomers · Generation X

1 Introduction

The rapidly growing world population as against the snail-paced expansion of traditional industries has lifted the discourse of entrepreneurship as the new "whiz kid" of economic activity. Increasingly, the conversation of employment in recent decades has shifted from 'getting a job' to 'creating one', in line with the occupational choice theory [1]. As global employment shrinks concerning job seekers, the notion of being entrepreneurial is now perceived as the haven of economic welfare, particularly for newer generations.

Meanwhile, to be a successful entrepreneur, researchers have shown that there are some general skills and competencies one must possess [2–5]. This is based on the

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fundamental understanding that the efficacy of the entrepreneurial process is dependent on some intrinsic characteristics within the Entrepreneur. Thus, conceptualizing entrepreneurship as the creation of a new venture [6] or in terms of new value creation [7], the competencies of the individual at the centre of this creation are critical in the entrepreneurial process of recognizing an opportunity, exploiting those opportunities and creating value out of those opportunities.

The suggestion that people must demonstrate some competencies in order to be entrepreneurs connotes that not all people can become entrepreneurs or better still, there are differences in personality features in terms of who could be a successful entrepreneur [8] and who cannot. Though this assertion of differences in entrepreneurial competencies remains profound in extant entrepreneurial literature, it appears very few studies have sought to establish the basis upon which specific individuals possess or demonstrate these competencies. An exception is the study of Mitchelmore and Rowley [4], that investigated the entrepreneurial competencies of female entrepreneurs. Their study, however, did not compare these competencies between the two main genders. The apparent absence of baseline studies that establish the differences in these entrepreneurial competencies among groups limits our understanding of the personality clusters that can demonstrate competencies necessary for successful enterprises.

Besides, the recent empirical literature has identified significant differences in the attitudes and personalities of newer generations as opposed to that of older generations [9–13]. Newer generations such as the millennials have been identified as extrinsically motivated and possessing high senses of individualism [9, 12] - attributes necessary to become a successful entrepreneur [14] - as compared to older generations who are motivated by intrinsic values and are more disposed to a collectivist culture [15]. Though these variances are profound in generational cohort studies, they seem not to have found their way into explaining how millennials could be more or less successful in becoming entrepreneurs than previous generations.

As part of the ongoing debate on ideal entrepreneurial competencies, this study seeks to make three significant contributions to the literature on entrepreneurship. First, this study introduces a generational dimension that explores how the generation an individual belongs to could be influential in determining their entrepreneurial competence. Second, this study discusses how millennials are different in their entrepreneurial competence as compared to older generations and finally, identifies the underlying personality traits that could make millennials more or less entrepreneurial than older generations.

2 Entrepreneurial Competence

Entrepreneurial competence is a concept that finds itself in two kinds of literature: entrepreneurship and competency literature [3]. Generally, entrepreneurship is defined as the creation of a new venture or in terms of new value creation [5–7]. Its focus is on the identification of opportunities and the ability to exploit such an opportunity [16]. This understanding of entrepreneurship thus underpins the establishment of an entirely new business. On the other hand, competency refers to the behaviour demonstrated by an individual that results in efficient or superior performance in a job [3].

Entrepreneurial competence thus refers to specific knowledge, motives, traits, self-images, social roles and skills that are essential for the birth, survival and growth of

a venture [17]. According to Man, Lau and Chan [18], entrepreneurial competencies refer to the total ability of the Entrepreneur to perform a job role successfully. It refers to the ability of an entrepreneur to be entrepreneurial. That is, the ability to identify opportunities, take risks and create novelty out of such opportunities.

3 Generational Cohorts

3.1 Millennials

Also referred to as Generation Y (GenY), GenMe, Net Generation, Millennials are individuals born between 1982 and 1999 [12]. The significance of the birth years of these group of individuals, just like other generations, is with regards their unique traits and personalities influenced by both genetic factors as well as environmental factors such as the availability of computers during their 'age'. According to Tapscott [19], Millennials could be described by eight main characteristics: (1) freedom to express themselves ad choose their own path; (2) the need to customize their world including jobs; (3) high levels of scrutiny as they learn early in their developmental years to be sceptical and critical about what they read and see; (4) display of integrity by being transparent and honest; (5) they collaborate well with friends and co-workers using tools like Facebook both at work and in their personal life; (6) high need for entertainment and leisure; (7) display of speed marked by instant response without time boundaries (24/7) and (8) the desire to innovate. They are regarded as natural leaders, initiators ad creators [19].

Fletcher and friends [20] also found that Millennials are more likely to be individualistic and desire more flexibility in their work and personal life. They expect flexible working hours and may even prefer to choose where and when to work [14]. In other words, Millennials are more likely to opt for flexibility in their work schedule over routine and strict eight or nine to five hourly jobs especially knowing how technology could have offered a virtual job location and routine [14]. There is, therefore, the notion among these generations to 'work smart' and not necessarily hard.

3.2 Older Generations (Baby Boomers and Generation X)

Generation X, those born from 1965 to 1981, is described as a generation of cynicism [15, 21] primarily due to their exposure to adverse events such as the Persian Gulf War, increases in divorce and crime, spread of AIDS [22]. Their exposure is attributed to the revolution caused by television and the media that introduced the generation to pop culture and increased their sensitivity to world events rather than localized issues [21]. Also, it is noted that the breaking of the glass ceiling during the period of this generation made them the first of the generational cohorts to witness both parents working outside the home [15]. This made them responsible for taking care of themselves while growing up whiles their parents were both still at work [23]. As such, GenXers are considered to have developed skills of independence, adaptability, resilience, high sense of achievement motivation and are also noted for being self-starters and resourceful [23]. They are also considered as committed to their work. However, there are arguments that they are often misguided and not loyal to their organizations because of their high propensity to switch jobs [15, 23].

On the other hand, Baby Boomers are those generations whose birth period coincided with the economic recovery period following World War II and the Great Depression [15]. They are those born from 1946 to 1964 and activities such as the rise of civil rights and women's movements affected these generations [13]. The large size of the Boomers earned them their name and is reported to have forced them to compete for resources ad opportunities [21]. The result has been that they strive to be in the lead of their generation and are workaholics who value their career and draw meaningfulness in life from same [15, 23] Professionals from the Society of Human Resource Management [24] described this generation as results-oriented, individuals who plan to stay for a long term and a generation that always strives to give maximum effort at work.

4 Entrepreneurial Competencies of the Generations

Several competencies have been identified as the ideal competencies necessary to be a successful entrepreneur. In order not to wallow in this unending debate, this study adopts Mitchelmore and Rowley's [4] framework of entrepreneurial competencies which incorporates several of the competencies identified by earlier researchers though the clustering may be different. Their competency framework is clustered into four groups, namely personal and relationship competencies, business and management competencies, entrepreneurial competencies and human relations competencies.

The personal and relationship competencies refer to the ability to negotiation and networking abilities of entrepreneurs that can create a long term trusting and loyal relationship with others [25]. It includes competencies such as communication and relationship-building skills and other personal traits of the individual [4]. Millennials have been found to place more importance on social work values, and the need to be collaborative and continuously engage in interaction [15, 20]. This interest in interaction is propelled by their comfort with the use of new technologies and intensive use of the internet as well as social media platforms. Thus, Millennials can develop more exceptional social networking ability through their superior use of digital platforms and technologies that shapes their work environment through computer-mediated communication and information technologies as compared to older generations.

Proposition 1: *Because of the comfort in the use of information and communication technologies by Millennials, they are more likely to develop exceptional personal and relationship competencies than older generations.*

Business and management competencies include those business and managerial functions such as financial and systems management, budgeting, business operations and business planning [4]. According to Twenge [13], Millennials are extrinsically motivated. Tapscott [19] identified that integrity in terms of honesty and transparency were among the significant characteristics of Millennials. Their high sense of curiosity coupled with the desire to maintain their social networks forces them into a prisoner's dilemma where they are required to act ethically by inculcating proper business plans and sound financial management practices that cater for the needs of their networks and helps to build trust in the relationship established.

Proposition 2: *Because of the need to maintain established relationships and build trust with their networks, coupled with their extrinsic motivation, Millennials are*

more likely to demonstrate better business and management competencies than their predecessors.

Entrepreneurial competencies refer to the ability of the individual to be innovative, creative, identify opportunities, take risks, carve a vision and generate ideas [4]. In a study by Guerrero and friends [26], it was found that Millennials are becoming more self-focused and independent. Hence, they are less committed to their formal organizations because of their itinerant nature which makes them pursue personal fulfilment [26]. Their finding is corroborated by previous studies that have shown that Millennials are more inclined to flexibility in their work and as such, find the need to customize their work [13,15.19]. This makes them more creative, fearless in taking risks and capable of generating novel ideas to create new businesses.

Proposition 3: *Because of the desire for flexibility and the customization of their work, Millennials are more likely to develop superior entrepreneurial competence such as risk-taking and the identification of opportunities than older generations.*

Human relations competencies include the human relations and line management functions in organizations such as the development of employees, hiring of staff, leadership, employee relations and staff motivation [4]. Millennials are described as extrinsically motivated [12]. This quality is a pre-requisite for raising the required funds for a new venture. Also, this quality is relevant for the maintenance of a successful enterprise where staff are well motivated. Besides, Millennials believe in networking and thus can better decentralize responsibilities to others through recruitment, training and the use of their leadership skills.

Proposition 4: *Because of the desire for extrinsic motivation and their need for networking, Millennials are more likely to create and maintain better human relations competencies than their predecessors.*

5 Challenges and Future Research Directions

The emphasis on entrepreneurial competence based on generational cohorts further introduces a 'born or made' argument into the entrepreneurial competence discourse. As not by Mitchelmore and Rowley [3], entrepreneurial competencies are qualities that can be learnt, thus perfected. It, therefore, seems to be problematic to suggest that the entrepreneurial competencies are the reserve of some individuals by virtue of the period within which they are born. That notwithstanding, preliminary investigations into some of the propositions advanced in this study have been confirmed empirically [see 14, 26]. However, there seem to be only a few such studies. This confirms to some extent, the potency of the propositions of the study.

It is however recommended for future studies to investigate the entrepreneurial competencies along the dimensions as proposed by Mitchelmore and Rowley [4] and further examine how the various generations (Millennials, GenX, Baby Boomers) could act as a boundary condition explaining the efficacy of founders' competencies. Also, future studies could examine comparatively the performance of enterprises owned by Millennials as against those owned by individuals of older generations in order to produce a performance-based finding that assesses propositions made in this study.

6 Conclusion

This timely mix of entrepreneurship and generational needs in recent years presents a new paradigm in the entrepreneurship literature. This study purported to explore the differences between newer generations, particularly, Millennials and older generations, including Generation X and Baby Boomers. From a review and mapping of the personality differences among these generations and the dominant entrepreneurial competencies, this study proposes that by virtue of their technological savviness, extrinsic motivation, desire for flexibility and customization of work and need to create and establish social networks, Millennials come across as possessing superior entrepreneurial competencies than older generations.

References

1. Gaweł, A.: The relationship between entrepreneurship and unemployment in the business cycle. J. Int. Stud. **3**(1), 59–69 (2010)
2. Chandler, G.N., Jansen, E.: The founder's self-assessed competence and venture performance. J. Bus. Ventur. **7**(3), 223–236 (1992)
3. Mitchelmore, S., Rowley, J.: Entrepreneurial competencies: a literature review and development agenda. Int. J. Entrep. Behav. Res. **16**(2), 92–111 (2010)
4. Mitchelmore, S., Rowley, J.: Entrepreneurial competencies of women entrepreneurs pursuing business growth. J. Small Bus. Entrep. Dev. **20**(1), 125–142 (2013)
5. Jain, R.K.: Entrepreneurial Competencies. J. Bus. Perspect. **15**(2), 127–152 (2011)
6. Gibbs, A.A.: Entrepreneurship and small business management: can we afford to neglect them in the twenty-first century business school? Brit. J. Manage. **17**(4), 309–324 (1996)
7. Bruyat, C., Pierre-Andre, J.: Defining the field of research in entrepreneurship. J. Bus. Ventur. **16**(2), 165–180 (2000)
8. Cromie, S., Johns, S.: Irish entrepreneurs: some personal characteristics. J. Occup. Behav. **4**(4), 317–324 (1983)
9. Anderson, H.J., Baur, J.E., Griffith, J.A., Buckley, M.R.: What works for you may not work for (gen)me: limitations of present leadership theories for the new generation. Leadersh. Q. **28**, 245–260 (2017)
10. Ahmad, H., Ibrahim, B.: Leadership and the characteristic of different generational cohort towards job satisfaction. Proc. - Soc. Behav. Sci. **204**, 14–18 (2015)
11. Rayani, A.: Generational Differences in Perceived Supervisory Support. Master's Thesis submitted to San Jose State University in Partial Fulfilment of the Requirements for the Degree Master of Science (2015)
12. Twenge, J.M.: A review of the empirical evidence on generational differences in work attitudes. J. Bus. Psychol. **25**, 201–210 (2010)
13. Twenge, J.M., Campbell, S.M., Hoffman, B.J., Lance, C.E.: Generational differences in work values: leisure and extrinsic values increasing, social and intrinsic values decreasing. J. Manage. **36**, 1117–1142 (2010)
14. Mihalcea, A.D., Mitan, A., Vitelar, A.: Generation Y: views on entrepreneurship. Econ. Ser. Manage. **15**(2), 277–287 (2012)
15. Hansen, J.I.C., Leuty, M.E.: Work values across generations. J. Career Assess. **20**(1), 34–52 (2012)
16. Shane, S., Venkataraman, S.: The promise of entrepreneurship as a field of research. Acad. Manage. Rev. **25**(1), 217–226 (2000)

17. Bird, B.: Towards a theory of entrepreneurial competency. Adv. Entrep. Firm Emerg. Growth **2**, 51–72 (1995)
18. Man, T., Lau, T., Chan, K.F.: The competitiveness of small and medium enterprises. A conceptualization with focus on entrepreneurial competencies. J. Bus. Ventur. **17**(2), 123–142 (2002)
19. Tapscott, D.: Grown Up Digital. How the Net Generation Is Changing Your World? McGraw-Hill, New York (2009)
20. Fletcher, F., Roberts, C., Gibson, C., Gibson, D., Cooke, D.R., Eldridge, L., Hoffman, W., Mundy, R.: Generational Cohorts and Their Attitudes Toward Work-Related Issues in Central Kentucky. Social Science Research Network (2009).http://ssrn.com/abstract=1484350
21. Lancaster, L.C., Stillman, D.: When Generations Collide: Who They Are. Why They Clash. How to Solve the Generational Puzzle at Work? Harper Collins, New York (2002)
22. Losyk, B.: Generation X: what they think and what they plan to do. Futurist **31**, 39–44 (1997)
23. Strauss, W., Howe, N.: Generations: The History of America's Future, 1584 to 2069. Quill William Morrow, New York, NY (1991)
24. Society of Human Research Management. SHRM generational differences survey report: A study by the Society for Human Resources Management. SHRM, Alexandria (2004)
25. Zizile, T., Tendai, C.: The importance of entrepreneurial competencies on the performance of women entrepreneurs in South Africa. J. Appl. Bus. Res. **34**(2), 223–236 (2018)
26. Guerrero, M., Amorós, J.E., Urbano, D.: Do employees' generational cohorts influence corporate venturing? A multilevel analysis. Small Bus. Econ. 1–28 (2019)

Public Administration and Economic Aspects of Ukraine's Nature Conservation in Comparison with Poland

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Abstract. This paper deals with the dynamics of the expenses for maintaining biodiversity by various sources. Polish experience concerning the taxation of land preservation, involvement of local authorities to address issues of biodiversity preservation management is used to improve biodiversity management system. The analysis of state and local biodiversity management systems of Ukraine is done. Classification of biodiversity conservation functions is carried out. The economic effect of biodiversity functioning is estimated using forests and swamps ecosystems as an example. The necessity of biodiversity in the GDP of the state is justified. Improved geo-information system of the cadastral data bank of the objects of the nature reserve fund, which ensures the implementation of measures aimed at preventing the destruction or damage to the territories and objects of the nature reserve fund, is proposed.

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Keywords: Ecosystems · Public administration · Biodiversity management system · Geoinformation system · Economic effect

1 Introduction

Protected areas are the basis of conservation of the gene pool of flora and fauna, typical and rare landscapes, maintaining favorable ecological conditions. The Natural Reserve Fund of Ukraine is a national heritage of the people of Ukraine and an integral part of the World Natural and Cultural Heritage. The ecological systems and their parts do not only preserve the unique natural landscapes and biological diversity of the country, but also contribute to the sustainable ecological development. The first global instrument for the protection of natural habitats was the Convention on Wetlands of International Importance, mainly as the habitat of waterfowl (the so-called Ramsar Convention or Wetland Convention) of 2 February 1971. As of 2019, there are 169 parties to the Ramsar Convention. The Wetlands Convention establishes a legal framework for national action and international cooperation for the protection and sustainable management of wetlands and their resources. The document provides for the creation of a List of Wetlands of International Importance in terms of ecology, botany, zoology, limnology or hydrology.

Biodiversity creates a safe and healthy environment, provides the population with food, medicines, raw materials for industry. It also supports the ecosystems functioning, including circulation and purification of natural waters, soil conservation and climate stability. That is why biodiversity is studied in a number of scientific papers, including [1–9]. Although humanity is not in imminent danger of making the atmosphere unbreathable in terms of oxygen, there is clear benefit in retaining such functions which is deteriorating due to anthropogenic damage [10–13]. The endless list of ecological features which humans are reliant on, are both biologically and economically beneficial for mankind. This concept of numerically valuing ecological features and functions has been adopted via systems of carbon credits and the concept of ecosystem services. Although far from perfect, these notions are favorable for a capitalistic world and representative of what ecological features mean to humans in a more tangible and economic sense.

2 Materials and Methods

The methods of evaluating the effectiveness of conservation have been used to better analyze the actual state of natural ecosystems, to investigate the dynamics of the cost of maintaining biodiversity by various sources (state budget of Ukraine, the cost of regional state administrations and local self-government). For improving management of biodiversity preservation, we have proposed to use Poland experience, concerning the taxation of land preservation, involvement of local authorities (communes) to address issues of biodiversity preservation management at the community and state authorized territory. The best foreign practices of biodiversity public administration and recommendations for its implementation in Ukraine have been given.

3 Results and Discussion

One of the prerequisites for Ukraine's accession to the European Union is the adaptation of national legislation to the European Directive 92/43/EC on the conservation of habitats, wild flora and fauna, as amended by Directive 97/62/EC, 2006/105/EC and Regulation (EC) № 1882/2003. The main objective of the Directive is to promote the conservation of biodiversity. The most important tool for the fulfillment of the tasks is the identification of territories of importance for the European Union – nature objects of pan-European importance, which, together with the special nature conservation areas, are determined in accordance with the Settlement Directive [14].

Poland signed an Association Agreement with the EU back in 1991 (entered into force in 1994). The process of approximation to EU environmental law went through several stages: harmonization (since the late 1990s), adaptation (from 2000–2001) and transposition (modern). The last step is often to copy the relevant provisions of the directives. This whole process has caused problems from the beginning, mainly due to the difference in traditions in the way environmental legislation of Poland and the EU has been drafted. In April 2003, an EU Accession Agreement was signed and Poland became a member of the EU in May 2004, and it was during this period – from April 2003 to April 2004 – that the most significant changes in national legislation related to the implementation of the directives in the field of protection took place, including the Wild Birds Directive.

In Ukraine today the main problem of public administration in the field of the PFP is that within the central apparatus of the Ministry of Energy there is a single special structural unit – the Department of Ecological and Conservation Affairs, which provides the organization, protection and efficient use of the nature reserve fund, and also implementation of the provisions of the Law of Ukraine "On the Nature Reserve Fund of Ukraine". Due to the proclamation of the state's course to increase the area of land of the protected areas, expansion of the network of objects of the nature reserve fund, the functioning of only one structural unit of the Ministry of Energy in the field of conservation management is insufficient.

It is determined that an important problem of management in the sphere of the nature reserve fund is measures to optimize the central executive authorities, namely the elimination as a legal entity of public law of all territorial bodies of the Ministry. Although regional structures have been established under regional state administrations, their functions have been limited. Paradoxically, the functions that limited the regional level expanded the powers of the central, which negatively affected the system of public administration. Conservation institutions are run by almost ten different agencies. At the same time, great attention should be paid to attracting foreign investors who can invest in the form of state-of-the-art equipment. This also requires the support of the state, providing guarantees for foreign investors. It is proposed to improve the geo-information system of the cadastral data bank of the objects of the nature reserve fund, which ensures the implementation of measures aimed at preventing the destruction or damage to the territories and objects of the nature reserve fund. A modern tool for managing the development of a conservation object and supporting decision-making in the form of a multi-layer electronic map is the geo-information system of the protected area. Geoinformation system serves as a single point of entry to information about the

object of the nature reserve fund, conducting in the institutions of the nature reserve fund of scientific research and informing citizens and promoting eco-educational knowledge, promotes the development of environmentally oriented types of tourism.

In order to implement positive international experience in the conservation and restoration of territories and objects of the nature reserve, we have considered the Wild Birds Directive 79/409/EEC (now 2009/147/EC) in Poland. This experience is extremely useful for Ukraine, where there is no state monitoring of the abundance of wild fauna, including birds. Wildlife is managed only by forest holdings in the hunting grounds. The full implementation of the Directive in Ukraine will inevitably lead to the creation of a large number of new special nature conservation areas. Such territories are created as separate statutory special types (forms) of nature conservation areas and do not replace the traditional system of nature conservation (reserves, national parks, etc.). They function "in parallel" in space and time, in particular their boundaries may coincide, in whole or in part, with traditional nature conservation areas. In Poland, for example, forest area of 9 million hectares and forest cover was 28.8% of the total area of the country (Table 1). For one person has an average of 0.24 ha of forest. In Ukraine, as forest conservation care of the State Agency of Forest Resources. Forest management at the local level state enterprise that are managed by the State Agency of Forest Resources of Ukraine and coordinated by its appropriate regional authority (Reskomlis Crimea, 24 regional departments of forestry and hunting). The economic evaluation of Ukraine forest and wetland ecosystems effectiveness was carried out in this research due to the fact that forested and open wetlands cover about 20% of Ukraine.

Table 1. The comparison of forest in Poland and Ukraine

Country	Area of forests, thousand ha	Share of forest, %	Area of Nature Protection Fund (NPF), thousand ha	Share of NPF from the total territory, %	Specific indexes			
					Forest on a one ha territory	Area of NPF on a one ha territory	Forest per one person, ha/person	NRF, per one person, ha/person
Poland	8890	28.5	7130.4	22.8	0.284	0.228	0.233	0.187
Ukraine	10400	15.9	3670.5	5.4	0.173	0.06	0.23	0.07

Although Ukraine has a larger area of the territory which is occupied by forests than Poland, but the proportion of the total territory is of nearly half. As table data is shown, area of forests of Ukraine is 10400 thousand ha, that is near 16% of the square of the state, area of forests of Poland is less – 8890 thousand ha, that is near 29% of the square of this state. Poland has 0.284 ha of forests for a one ha territory, while Ukraine has only 0.173 ha. The negative trend is that the area of the nature reserve fund in Ukraine is four times less than in Poland −5%, compared with 22%. Finally, the area of the natural reserve fund in Ukraine is negligible compared to Poland – and it is only 0.07 ha/person, that is almost three times less [15]. Today, Ukraine cannot stay away from the prevailing world market ecosystem services due to the threat of global ecological crisis. The

national economy formation delay leads to the annual loses of foreign investment in the environmental performance development. The generalization of domestic and international experience, presented in experts works, allowed to differentiate six approaches to economic evaluation of biodiversity functioning (economic assessment based on the final national economy results, socio-economic assessment, experts review, costly techniques, rental approach and the total economic value concept). The most promising is the total economic value concept, as it provides a comprehensive approach to assessing biodiversity [16]. The calculation of economic efficiency of Ukraine forest and wetland ecosystems was carried out on the basis of the developed methods, which are based on the concept of total economic value. An annual economic impact of Ukraine wetlands wastewater treatment is about $86 million. The total mass oxygen deposition from forests and swamps is about 60 million tons, which allows ensuring the livelihoods of 147 million people, which is three times more than the population of Ukraine. One of the innovative tools to attract foreign investment in Ukraine is the implementation of the Kyoto Protocol. Economic grounding allows coming to the conclusion that Ukraine forest ecosystems efficiency occupies the second place after Russia. Ukraine forest ecosystems are able to provide livelihoods to population up to 63 million people and be the second after Poland. As carbon recipient countries, Moldova and Belarus should compensate Ukraine for these effects on forest preservation. This would allow Ukraine to restructure its external debt.

Some empirical correlations between economic efficiency and other indicators (population, state size, specific indicators) have been found. As shown by the correlation-regression analysis, carried out in this paper – the determination coefficient is 0.92. That is, this indicator is close to one, which means that the link between these figures is very close. That is, there is a close relationship between the area of the state occupied by forests, the population and the indicator of economic productivity of natural (forest) ecosystems.

4 Conclusions

In the process of research authors have come to such conclusions and recommendations:

1) As of 01.09.2019, 315 territories and objects with a total area of 206.9 thousand hectares are assigned to the network of the nature reserve fund, which is approximately 10%, and 310 territories and objects have been added to the geo-information system of the cadastral information database. Today, the mapping material is transformed into digital bitmaps and the necessary updating of the subsystems of the geoinformation system of the cadastral data bank and the digital map of the territories and objects of the natural resources of the region is carried out. This updated system will allow to form a comprehensive territorial view of the objects of the nature reserve fund, as well as to use for making informed and sound management decisions when allocating land and providing subsoil for use. In order to implement positive international experience in the conservation and restoration of territories and objects of the nature reserve, we have considered the Wild Birds Directive 79/409/EEC (now 2009/147/EC) in Poland. This experience is extremely useful for Ukrainians, where

there is no state monitoring of the abundance of wild fauna, including birds. Wildlife is managed only by forest holdings in the hunting grounds.

2) It is established that the successful use of the territories and objects of the nature reserve fund depends on a clear and coordinated mechanism for managing them. Management of the nature reserve fund is an objective necessity and is the organizing activity of state, self-governing and public bodies for the practical implementation of the tasks assigned to the nature reserve fund and aimed at the organization (creation) of such territories and objects, their protection, as well as the use natural complexes for clearly defined purposes, ensuring the unity of the principles of the bequest regardless of the tasks and purpose of a particular object and its subordination, the organization of accounting of the natural resources of these territories t objects, evidence-based planning of their network, monitoring the compliance with their legal regime. In addition, given the best practices of European countries, in our opinion, it is necessary to develop multi-level systems of targeted integrated programs for the development of natural and recreational areas, as they are a powerful tool for activating the reserves of economic and social growth of the regions. The development of such programs will provide the necessary benchmarks that will determine the dominant trends, indicative quantitative parameters of socio-economic and environmental development, their place in the inter-regional division of labor, outline and adjust in the forecast dynamics of national and regional markets their own regulatory influences on economic and economic processes.
3) The main investor in this area should be the state. Here, assistance is needed in the form of budget financing, provision of preferential lending, introduction of preferential taxation, free allocation of land for construction of facilities of in-patient recreation. At the same time, great attention should be paid to attracting foreign investors who can invest in the form of state-of-the-art equipment. This also requires the support of the state, providing guarantees for foreign investors. Biodiversity should receive adequate economic assessment to reflect the GDP as national wealth. According to calculations economic evaluation of Ukraine forests and wetlands functioning is more than 1.88 billion. United States (2% of GDP and 5% of the State Budget of Ukraine 2009 level; 3% of the State Budget of Ukraine 2013 level). The economic account of these functions of biodiversity in GDP will allow to form in Ukraine the market of ecosystem services and to attract foreign investments for nature protection activity realization. Display of biodiversity cost-effectiveness in the state national accounts and ecosystem services will allow restructuring Ukraine's foreign debt (104 billion dollars.) over 15–20 years.
4) To improve the geo-information system of the cadastral data bank of the objects of the nature reserve fund, which ensures the implementation of measures aimed at preventing the destruction or damage to the territories and objects of the nature reserve fund has been proposed. A modern tool for managing the development of a conservation object and supporting decision-making in the form of a multi-layer electronic map is the geo-information system of the protected area. Geoinformation system serves as a single point of entry to information about the object of the nature reserve fund, conducting in the institutions of the nature reserve fund of scientific research and informing citizens and promoting eco-educational knowledge, promotes the development of environmentally oriented types of tourism.

5) The total economic value concept in terms of the direct and indirect functions of the biodiversity components is the most appropriate for the economic evaluation. Methods of economic evaluation of biodiversity by law developed by this research should be introduced. This will take account of biodiversity functions such as: wetlands water purification functions, forests and swamps oxygen production, health effects of recreational activities. The economic record of biodiversity functions in GDP will generate ecosystem services market in Ukraine and attract foreign investment into the environmental activities' implementation.

In addition, this present study is based on single data collection method, while future studies may include multiple methods, for instance, interviews and case studies in order to mitigate possible bias, if any. Our future research will focus on world-class effective management models that work well in developed countries in the field of biodiversity conservation.

References

1. Andriyenko, T.L., Shelyah-Sosonko, YuR: The Vegetation Cover in the Ukrainian Polesie in Aspect of its Protection. Naukova dumka, Kyyiv (1983)
2. Didukh, Ya.P., Plyuta, P.H., Karkutsiyev, H.M.: Ecological features coenotic of Shatsky National Natural Park. The problems of forest ecology and forest use in Polesie of Ukraine, vol. 5, pp. 147–154 (1998)
3. Hryshchenko, YuM, Mykytyn, T.M.: Natural-Protection Fund of Rivne Region. Volyns'ki oberehy, Rivne (2008)
4. Koshkalda, I.V., Tyshkovets, V.V., Suska, A.A.: Ecological and economic basis of anti-erosion stability of forest-agrarian landscapes. J. Geol. Geogr. Geoecol. **27**(3), 444–452 (2018)
5. Maksymiv, Y.: Reporting as an important tool in ensuring interaction between stakeholders. Actual Probl. Econ. **4**(178), 304–310 (2016)
6. Popadynets, N., Maksymiv, Yu.: Developemnt of domestic solid biofuel market in Ukraine under current conditions. Econ. Ann.-XXI **159**(5–6), 93–96 (2016)
7. Razovskiy, Yu., Saveleva, E., Ulitskiy, O., Sukhina, O.: Ecological superprofit management in subsoil use. Eurasian Mining **2**, 27–29 (2019)
8. Suhina, O., Shults, S., Tkach, V., Popadynets, N., Kamushkov, O.: Methodology of evaluating economic losses resulting from partial loss of the air ecosystem's assimilative capacity. J. Geol. Geogr. Geoecol. **28**(1), 188–198 (2019)
9. Yakubiv, V., Panukhnyk, O., Shults, S., Maksymiv, Y., Hryhoruk, I., Popadynets, N., Bilyk, R., Fedotova, Y., Bilyk, I.: Application of economic and legal instruments at the stage of transition to bioeconomy. In: Ahram, T. (eds.) Advances in Artificial Intelligence, Software and Systems Engineering. AHFE 2019. Advances in Intelligent Systems and Computing, vol. 965. Springer, Cham (2020). https://link.springer.com/chapter/10.1007/978-3-030-20454-9_64
10. Fung, I., Doney, S., Lindsay, K., John, J.: Evolution of carbon sinks in a changing climate. Proc. Nat. Acad. Sci. U. S. Am. **102**(32), 11201–11206 (2005)
11. Leconte, J., Forget, F., Charnay, B., Wordsworth, R., Pottier, A.: Increased insolation threshold for runaway greenhouse processes on earth-like planets. Nature **504**(7479), 268–271 (2013)
12. Babczuk, A., Kachniarz, M.: The financing system of national parks in Poland. Status and trends of desired changes. Jelenia Góra: Wydawnictwo «Ad Rem» (2015)
13. Olaczek, R.: The Treasures of Nature and Llandscape of Polish. MULTICO, Oficyjna Wydawnicza, Warszawa (2008)

14. Symonides, E.: Nature Conservation. Wydawnictwa Uniwersytetu Warszawskiego, Warszawa (2008)
15. Kalbarczyk, E., Kalbarczyk, R., Kasprzak, K., Krajewski, P., Raszka, B.: National Parks in Poland. Wydawnictwo Dragon, Bielsko-Biała (2016)
16. Yakymchuk, A., Mykytyn, T., Valyukh, A.: Management of protected areas of ukraine's polissia: international experience. Probl. Perspect. Manage.: Int. Res. J. **15**(1), 183–190 (2017)

Sustainability

Comparative Analysis of Barriers for Renewable Energy Technologies Diffusion in Finland and Poland

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Abstract. Renewable Energy Technologies (RETs) are critical for the energy transition towards environmentally friendly solutions. There are many international regulations enhancing climate change mitigation. However, on a national level, disruptive technologies often struggle with many various barriers. There is ample evidence supporting the claim that innovative energy technologies require the whole ecosystem to support their diffusion. In fact, it is often a case that the change starts at the regional level. Therefore, some country-specific limitations are worth investigating.

In this study, we examine various barriers of renewable energy technologies diffusion in the case of two European countries: Finland and Poland in the first phase. It served to perform a comparative analysis in a second stage, revealing the similarities and differences between them. An analysis provides insightful knowledge about the current constraints of widespread and effective renewable energy technologies diffusion. As a conclusion, the directions and possibilities for improvement are suggested.

Keywords: Renewable energy · Barriers · Technology diffusion · Sustainable regional development · Comparative analysis

1 Introduction

Climate change is becoming an increasingly important issue for the international community. Numerous efforts to minimize its adverse impact have been made through the implementation of certain policies, namely by the United Nations and agendas of the European Union. The goals of recent regulations for 2020 were aimed at reducing greenhouse gases (GHG) emissions by 20% compared to 1990, as well as increasing the usage of renewable energy sources (RES) and energy efficiency to 20% [7]. New targets for 2030 were set and they are even more ambitious: 40% CO2 emissions cut compared to

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1990 realities, 32% RES share and 32,5% energy efficiency [6]. Moreover, the European Commission has presented the strategy for climate-neutral Europe by 2050, aiming at 80–95% GHG emissions reduction compared to 1990 levels and RES usage of 50% [8]. European Union policies are in line with the UN Paris Agreement [37] objective to maintain the global temperature increase to well under 2 °C and pursue efforts to cling to 1.5 °C. As can be seen, international policies play a key role when it comes to leading the way towards facing the challenges connected with global warming. According to [5], renewable energy markets are likely to develop more by dint of supportive policy frameworks and less through the determinations of mere competitive and commercial interests. Furthermore, governments tend to implement the RETs into the energy sector when they can clearly observe the potential benefits, with special regard to the long-term interest, that they can provide. They can be presented in different forms, e.g. sustainable development [14], energy security [39] or proficient use of native resources [1]. However, in order to enhance an improvement in that aspect, a multi-level contribution from different interest groups coming from various sectors is necessary. It is argued that the successful diffusion of renewable energy technologies requires the whole ecosystem to support it [33]. It is also claimed that technology push, market pull, and the regulatory framework are the key drivers of green innovation and thus, of sustainable cleaner production [15]. Moreover, environmental awareness of consumers is a vital variable, since ecologically sound products may be brought in through market pull elements [31]. Therefore, environmental policies persuade businesses to develop sustainable innovations.

Still, the challenges to business are meaningful: throughout industries, enterprises are increasingly struggling with social and environmental difficulties while stakeholders expect firms to operate according to the concept of a triple-bottom-line of economic, environmental and societal value generation [11], rather than sole short-term income orientation [14]. On the other hand, being environmentally sound and energy-efficient will not guarantee renewable energy initiatives will gain and sustain a long-period market share and there is a cost decrease requirement in order to become competitive with the conventional solutions. Nonetheless, it is argued that the cost of energy generation from renewables will become competitive if the cost of harnessing the environment and internalizing the externalities are considered [24].

There are numerous studies exploring renewable energy diffusion. As it is a complex and multi-perspective process, researchers focus on different specific renewable energy sources e.g. biogas [4, 29, 38] wind energy [22], or solar PV [28]. Moreover, authors tend to contextualize it to certain factors or viewpoints of different interest groups as well as to conduct case studies on different geographical areas. For instance, [32] or [35] examined the barriers of renewables adoption from the customer's perspective, while [5] expresses the investor's viewpoint. Studies led by [30] and [17] explored the social acceptance and so-called willingness-to-pay aspects. Authors like [36] and [27] focused on the technology diffusion process in the sustainable energy context. Nevertheless, the mainstream of research on renewable energy diffusion focuses on energy policy analysis [19, 20].

However, in this study, we decided to take a holistic approach towards RES as well as the diffusion and its barriers, following the tactic of e.g. [16], [3], or [33]. This method helps in analyzing the barriers of different kind in two European countries taken

into the scope of this research: Finland and Poland, which allows us to make a cross-case comparative analysis. After making such a comparison of key barriers in each country, brief solutions for the betterment of the existing state of affairs are proposed in conclusions.

2 Major Barriers of RES Diffusion in Finland and Poland

The literature on barriers to the successful adoption of various RES is quite bountiful. For instance, [32] studied the non-environmental barriers in the viewpoint of Finnish electricity customers and they have identified three categories: cognitive, characterized by the lack of knowledge and trust; orientational, connected with time and effort linked to prior habits and preferences; and economic, referring to the relatively higher cost. Moreover, [24] pointed out externality costs as market-related barriers, and these are the cost of damaging the environment and GHG emissions, which are often unconsidered in business strategies. In addition, [2] studied the potential for different renewable energy sources in Finland, which concluded in collective barriers and they are the following categories: environment, cost, or policy. Furthermore, [18] presented energy efficiency barriers in Finland, and determined insufficient technical skills, non-functional regulation or imperfect information flow as key obstacles perceived by the energy companies. However, in order to express country-specific barriers, it is important to include National Renewable Energy Action Plans from both countries, which were created to efficiently, realistically and appropriately respond to the legally binding obligations resulting from the international regulations mentioned before (namely the Directive 2009/28/EC). In the case of Poland, the target for the RES share in total energy consumption in 2020 has been reduced to 15% and the goal of 10% biofuels share in the transport industry has been additionally set [21, 25]. In the case of Finland, the expected share of RES has been raised to 38%, and in terms of GHG emissions, the national target referred to the 2005 level and aimed at a 16% decrease. What makes Finland a role model for the rest of Europe, these targets have been reached already in 2014 [9].

As can be concluded from Fig. 1, solid biofuels are the main RES type in the total energy generation (for electricity, heating and transport purposes) in the whole EU. In energy statistics, they refer to the *"product aggregate equal to the sum of charcoal, fuelwood, wood residues and by-products, black liquor, bagasse, animal waste, other vegetal materials and residuals and renewable fraction of industrial waste", whereas liquid biofuels is "the sum of biogasoline, biodiesels, bio-jet kerosene and other liquid biofuels"* [10]. Both Finland and Poland are characterized by an abundance of forest and agricultural areas, hence wood fuels and biomass have the biggest share in these countries. However, in the case of electricity production, which has a leading position in terms of energy usage, different RES break into the mainstream. In Finland, the share of RES in electricity generation in 2018 amounted to 46%, with hydro (42%), black liquor (21%), other wood fuels (19%) and wind (16%) [23]. In Poland, the wind took the leading role with a 59% share, followed by solid biofuels (25%), hydro (9%) and biogas (over 5%) [34].

A major barrier for RES diffusion in Poland, a coal-based energy mix, is of a complex nature since it has many unfavorable implications. National energy policies are insufficient and ineffective in terms of RES adoption because the focus is still being put on

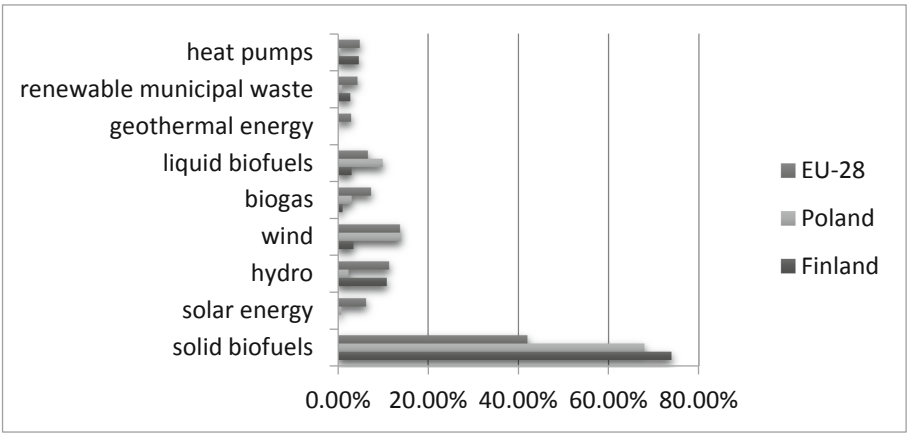

Fig. 1. Renewables by source type in 2017. Source: Own calculations based on [34]

the coal and lignite sector development. This is due to long-lasting experience, and thus, reluctance to change the current state of affairs, which would require the transformation of the whole infrastructure, including e.g. smart grids installment.

The Polish *'coal culture'* is strongly cultivated, which has had even more socioeconomic consequences: limited financial resources and changes in the EU support (e.g. reduction of feed-in tariffs or green certificates). It results in the lack of social and political acceptance, expressed in the unwillingness to pay more for the green energy as well as fear of the consequences of such change to the mining industry.

In Finland, the major barriers to RES adoption are market-related. Finland, being a developed country, has a solid infrastructure and regulatory support needed for the RES diffusion [33]. Energy transition became the country's inter-sectoral priority. Therefore, a key barrier to the RET diffusion that Finnish companies face, is a relatively small demand for the green energy, compared to the conventional-sourced solutions (Fig. 2).

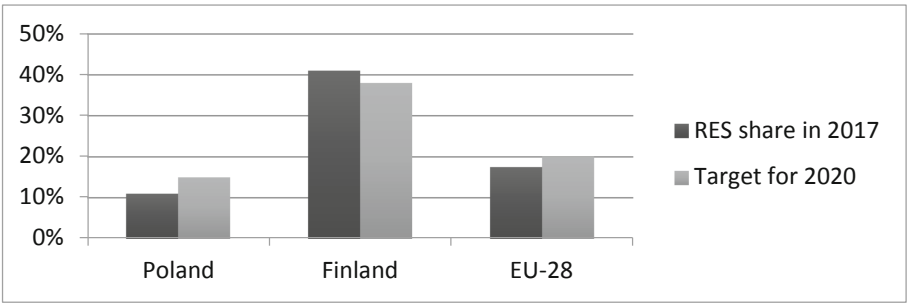

Fig. 2. Renewables share in total gross consumption. Source: own calculations based on [34]

This critical economic barrier is due to the small-sized domestic market, which in consequence, pushes business initiatives to internationalize their operations. It is even

more troublesome for the start-ups and SMEs, often struggled by the lack of strategic, managerial human and financial resources, which often do not consider the commercialization aspect, but focus solely on the technology development process [33]. Moreover, according to the study by [40] with the existing energy infrastructure, Finland has a limited capacity of a maximum of 50% RES share (Table 1).

Table 1. Summary of the analysis

Comparison aspect	Finland	Poland
EC & UN/national goals for 2020 – are they met?	RES share 38% - **YES** GHG emissions 16% lower than in 2005 – **YES** 10% biofuels in transport – **YES,** 18.8% in 2017 Energy efficiency of 35.9 Mtoe – **NEARLY**, 32.9 Mtoe in 2018	RES share 15% - **NO**, 11% in 2017 GHG emissions 20% lower than in 1990 – **NO** 10% biofuels in transport – **NO**, 4.2% in 2017
Major RET diffusion barrier(s): 1) Economic/market 2) Policy/regulatory 3) Social/behavioral	Dynamic and small-sized domestic market, uncompetitive green energy prices, long payback time, imperfect information flow	Coal-based energy mix, ineffective policies, reduction of subsidies (e.g. feed-in tariffs), limited infrastructural and financial resources
RES with the highest share/development potential	Solid biofuels (wood fuels, black liquor), hydro, wind	Solid biofuels (biomass), wind, liquid biofuels, biogas

3 Conclusions and Suggestions Towards Improvement

The analysis performed reveals insightful information about differences and similarities between Poland and Finland. These two European countries have agreed to implement national policies aiming at addressing obligations coming from international regulations. However, only Finland had successfully fulfilled its renewable energy goals. This is due to differences in resources, infrastructure, and behavioral patterns. Finland is one of the most innovative countries in the world [12], having a strong cultural foundation towards climate change mitigation. The fact that it has nuclear power plants is also crucial since the usage of conventional, high-emission energy sources is reasonably limited. Conversely, in Poland, a coal-centered energy sector with nearly 90% of coal in total energy usage (coal and lignite combined), classifies this country as struggling with the energy transition strategy implementation.

In order to overcome the most significant barriers in these countries, intensive multi-level cooperation of the energy industry, government, academia, and society is highly expected. Namely, a further institutional contribution is necessary since a supportive regulatory framework is seen as a catalyst for renewable energy technologies diffusion. In Poland, the defenders of the current state of affairs could perhaps learn from the German example of a swift and effective transition from a coal-based economy towards RET (*vide* Energiewende) [13]. Moreover, societal barriers are common for both countries,

and they concern e.g. noise-disturbing, animal-endangering and landscape-destroying wind power plants or foul-smelling biogas plants. This phenomenon called 'Not-In-My-Backyard' (NIMBY) [26] could be addressed by some promotion and awareness-raising actions. Lastly, efforts directed toward the further development of biomass- and waste-based CHP (combined heat and power) technologies would significantly improve the current state of affairs in both countries.

References

1. Aslani, A., Naaranoja, M., Wong, K.F.V.: Strategic analysis of diffusion of renewable energy in the Nordic countries. Renew. Sustain. Energy Rev. **22**, 497–505 (2013)
2. Aslani, A., Naaranoja, M., Helo, P., Antila, E., Hiltunen, E.: Energy diversification in Finland: achievements and potential of renewable energy development. Int. J. Sustain. Energy **32**(5), 504–514 (2013)
3. Beck, F., Martinot, E.: Renewable energy policies and barriers. In: Cleveland, C. (ed.), Encyclopedia of Energy, pp. 365–383. Academic Press/Elsevier Science, San Diego (2004)
4. Budzianowski, W.M.: Sustainable biogas energy in Poland: prospects and challenges. Renew. Sustain. Energy Rev. **16**(1), 342–349 (2012)
5. Dinica, V.: Support systems for the diffusion of renewable energy technologies—an investor perspective. Energy Policy **34**(4), 461–480 (2006)
6. EC: GREEN PAPER A 2030 framework for climate and energy policies (2013). https://eur-lex.europa.eu/legal-content/EN/TXT/?uri=CELEX:52013DC0169
7. EC: 2030 Climate and Energy Goals for a Competitive, Secure and Low-Carbon EU Economy (2014). http://ec.europa.eu/clima/policies/2030/documentation_en.htm
8. EC: A Clean Planet for all, A European strategic long-term vision for a prosperous, modern, competitive and climate neutral economy, COM/2018/773 final (2018). https://eur-lex.europa.eu/legal-content/EN/TXT/?uri=CELEX:52018DC0773
9. EC: Europe 2020 targets: statistics and indicators for Finland (2019). https://ec.europa.eu/
10. Eurostat: Statistics explained, Glossary: Biofuels (2019). ISSN 2443-8219, https://ec.europa.eu/eurostat/statistics-explained/index.php/Glossary:Biofuels
11. Elkington, J.B.: Cannibals with Forks: the Triple Bottom Line of 21st Century Business. Capstone Publishing, Oxford (1997)
12. Global Innovation Index 2019. https://www.globalinnovationindex.org/gii-2019-report
13. Hake, J.F., Fischer, W., Venghaus, S., Weckenbrock, C.: The German Energiewende–history and status quo. Energy **92**, 532–546 (2015)
14. Hockerts, K., Wüstenhagen, R.: Greening Goliaths versus emerging Davids - theorizing about the role of incumbents and new entrants in sustainable entrepreneurship. J. Bus. Venturing **25**(5), 481–492 (2010)
15. Horbach, J., Rammer, C., Rennings, K.: Determinants of eco-innovations by type of environmental impact: the role of regulatory push/pull, technology push and market pull. Ecol. Econ. **78**, 112–122 (2012)
16. Jacobsson, S., Johnson, A.: The diffusion of renewable energy technology: an analytical framework and key issues for research. Energy Policy **28**(9), 625–640 (2000)
17. Jung, N., Moula, M.E., Fang, T., Hamdy, M., Lahdelma, R.: Social acceptance of renewable energy technologies for buildings in the Helsinki metropolitan Area of Finland. Renew. Energy **99**, 813–824 (2016)
18. Kangas, H.L., Lazarevic, D., Kivimaa, P.: Technical skills, disinterest and non-functional regulation: Barriers to building energy efficiency in Finland viewed by energy service companies. Energy Policy **114**, 63–76 (2018)

19. Kitzing, L., Mitchell, C., Morthorst, P.E.: Renewable energy policies in Europe: converging or diverging? Energy Policy **51**, 192–201 (2012)
20. Monni, S., Raes, F.: Multilevel climate policy: the case of the European Union. Finl. Helsinki. Environ. Sci. Policy **11**(8), 743–755 (2008)
21. National Renewable Energy Action Plan. Polish Ministry of Economy. Warsaw (2010). https://ec.europa.eu/energy/en/topics/renewable-energy/national-renewable-energy-action-plans-2020#forecasts. Accessed 03 Jan 2020
22. Niemi, R., Mikkola, J., Lund, P.D.: Urban energy systems with smart multi-carrier energy networks and renewable energy generation. Renew. Energy **48**, 524–536 (2012)
23. Official Statistics of Finland (OSF): Production of electricity and heat [e-publication]. ISSN=1798-5099. 2018, Appendix figure 2. Electricity generation with renewables (2018). http://www.stat.fi/til/salatuo/2018/salatuo_2018_2019-11-01_kuv_002_en.html
24. Owen, A.D.: Renewable energy: externality costs as market barriers. Energy Policy **34**(5), 632–642 (2006)
25. Paska, J., Surma, T.: Electricity generation from renewable energy sources in Poland. Renew. Energy **71**, 286–294 (2014)
26. Pelham, B.W.: Not in my back yard: egocentrism and climate change skepticism across the globe. Environ. Sci. Policy **89**, 421–429 (2018)
27. Popp, D., Hascic, I., Medhi, N.: Technology and the diffusion of renewable energy. Energy Econ. **33**(4), 648–662 (2011)
28. Pietruszko, S.M.: The status and prospects of photovoltaics in Poland. Renew. Energy **16**(1–4), 1210–1215 (1999)
29. Piwowar, A., Dzikuć, M., Adamczyk, J.: Agricultural biogas plants in Poland–selected technological, market and environmental aspects. Renew. Sustain. Energy Rev. **58**, 69–74 (2016)
30. Ruggiero, S., Onkila, T., Kuittinen, V.: Realizing the social acceptance of community renewable energy: a process-outcome analysis of stakeholder influence. Energy Res. Soc. Sci. **4**, 53–63 (2014)
31. Sáez-Martínez, F.J., Lefebvre, G., Hernández, J.J., Clark, J.H.: Drivers of sustainable cleaner production and sustainable energy options. J. Clean. Prod. **138**, 1–7 (2016)
32. Salmela, S., Varho, V.: Consumers in the green electricity market in Finland. Energy Policy **34**(18), 3669–3683 (2006)
33. Shakeel, S.R., Takala, J., Zhu, L.D.: Commercialization of renewable energy technologies: a ladder building approach. Renew. Sustain. Energy Rev. **78**, 855–867 (2017)
34. Statistics Poland (GUS). Statistical analyses. Energy from renewable sources 2018. Warsaw (2019). ISSN 1898-4347, Accessed 03 Jan 2020
35. Tapaninen, A., Seppänen, M., Mäkinen, S.: Characteristics of innovation: a customer-centric view of barriers to the adoption of a renewable energy system. Int. J. Agile Syst. Manage. **4**, 98–113 (2009)
36. Tsoutsos, T.D., Stamboulis, Y.A.: The sustainable diffusion of renewable energy technologies as an example of an innovation-focused policy. Technovation **25**(7), 753–761 (2005)
37. United Nations Framework Convention on Climate Change (UNFCCC): Paris Agreement (2016). https://unfccc.int/resource/docs/2015/cop21/eng/10a01.pdf
38. Winquist, E., Rikkonen, P., Pyysiäinen, J., Varho, V.: Is biogas an energy or a sustainability product?-Business opportunities in the Finnish biogas branch. J. Clean. Prod. **233**, 1344–1354 (2019)
39. Wohlgemuth, N., Wojtkowska-Łodej, G.: Policies for the promotion of renewable energy in Poland. Appl. Energy **76**(1–3), 111–121 (2003)
40. Zakeri, B., Syri, S., Rinne, S.: Higher renewable energy integration into the existing energy system of Finland–Is there any maximum limit? Energy **92**, 244–259 (2015)

The Sustainable Potential Development of Aquaponics in Portugal: An Exploratory Study on the Stakeholders Perceptions

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Abstract. Aquaponics is an agricultural practice recognized as innovative and sustainable by the Food and Agriculture Organization (FAO) of the United Nations. Aquaponics is experiencing a period of rapid interest by the scientific community, public decision-makers, start-ups and new generation of farmers and businessmen. In the United States, aquaponics vegetables products can be certified as organic, since 2008. In Europe, the first start-ups are just taking the first steps of industrial production. The COST Action FA 1305 allowed the development of a European Hub of aquaponics. Regarding the Portuguese market, the coverage of aquaponics by the media and broadcast has been intensive, as well as the scientific and public debate stimulated by the field. However, the socio-economic and institutional problems concerning to the commercial development of Portuguese aquaponics products remains unsolved. This study tries to overcome this gap and offers recommendations on how to promote the development of commercial aquaponics in Portugal. The methods include the qualitative analysis of interviews directed to the main stakeholders in aquaponics in Portugal. The results confirm problems at an institutional level that difficult the development of aquaponics in the Portuguese market. Yet, results seem to indicate that local decision-makers, entrepreneurs and few young farmers are very motivated to develop aquaponics in the Portuguese market. Therefore, we recommend more attention from public decision-makers to solve the main institutional restrictions of this innovative and sustainable activity.

Keywords: Aquaponics · Sustainable agriculture · Production · Stakeholders' perceptions

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1 Introduction

Aquaponics is an innovative smart and sustainable production system, recognized by the Food and Agriculture Organization (FAO) of the United Nations [1, 2], for integrating aquaculture with hydroponic vegetable crops in a combination of fish farming and soilless plant farming [2, 3]. Aquaponics, as both an innovative agricultural practice and business, is experiencing a period of rapid growth with practical application in at least 43 countries around the world and on every continent [3]. In the United States of America (USA), aquaponics systems and producers have had the greatest development. This development in USA's aquaponics industry is not unrelated to the fact that, since 2008, aquaponics vegetables products can be certified as organic, according to the rules laid out in the federal law by the National Organic Program of the United States Department of Agriculture [4].

In the European countries, many start-ups and aquaponics systems in Research Centres and Universities for research and educational purposes are taking the first steps. In Portugal, most of the aquaponics systems, either for business or educational purposes, are at a conception stage, with the exception of three cases that already started their activity. According to the sectorial trends, aquaponic technology might evolve in at least two directions [5]: the first relates to low-tech solutions, probably mostly in developing countries and for hobbyists; and the second, highly efficient hi-tech installations, predominantly in developed countries and with professional/commercial partners [5].

Until now there are few studies from the stakeholder's perspective, with limited survey-based results (e.g., [6] in the Malayan market) and almost no studies on the European market [7]. Hence, the present study is an attempt to explore the viability of aquaponics-based businesses, in the particular case of the Portuguese market, as a sustainable way of food production, as well as an agricultural technology of high value-added for fresh and healthy foods, from the point of view of managers' perspectives. Specifically, the study investigates the following questions:

1) What are the perceptions and acceptation of agricultural managers, entrepreneurs and other decision-makers regarding aquaponics practices and businesses?
2) What kind of limitations firms and managers face in the implementation of aquaponics practices?
3) What is the perception of Portuguese firms about these limitations and in what measure do they affect their performance and investment in aquaponics?
4) What actions are policy and local decision-makers taking (or ought to take) to promote the sustainable development of innovative businesses in aquaponics and improve a positive market knowledge on aquaponics products? Are there any limitations or gaps in the law that prevent the development of aquaponics?

2 Institutional Framework of Commercial Aquaponics Development

Regarding the main institutional restrictions at the European framework [7] and [8]. refers: *i)* the current institutional European framework, the gaps in legislation and the lack

of legislative uniformity among EU Member States (EU MS), with negative impact on the trade of aquaponics within the European market, as well as, the gap in legislation among European countries; *ii)* the European Standard Classification of Productive Economic Activities [7] does not have a general or specific code for aquaponics but only separate codes for animal or plant production, hindering the commercialization of aquaponics products and bringing financial restrictions to a farm; iii) The absence of a certification of organic for aquaponics products in Europe (as used in the USA for vegetable production, which can be commercialized as organic), as a way to add value to both the business and the product.

Given the importance of aquaponics as a sustainable way of producing food, there is the need to study it at the level of economic impact, business development, and stadtholders behaviour. Firstly, it is necessary to understand the level of acceptance of the different stakeholders involved in sustainable and urban food production practices [2]. Also, there is the lack of rules and laws to legitimate and guide these kinds of agricultural practices in European countries [8] and [2]. All these aspects challenge for the importance to hear opinion leaders, local and governmental decision-makers and entrepreneurs, etc., and exploring their motivations and perceptions on aquaponics products and practices. Given the scarcity of studies on aquaponics economy and management, in particular, in the European market, this exploratory study based on in-depth interviews to the local and governmental decision-makers, entrepreneurs, and other agricultural specialists presents contributions to the field.

3 Study Design and Methods

This study of exploratory nature aims at studying how agricultural managers and entrepreneurs are making use of aquaponics technologies to develop innovative agricultural businesses in the Portuguese market and what is the role of public decision-makers and institutions in this process. The study also inquiries about their perceptions on market acceptation of aquaponics products. Finally, the study strives to shed light on whether institutions and European rules and laws are creating the right conditions for the development of this sustainable agricultural technology of high value-added for fresh and healthy foods, and its application to urban agriculture. Departing from this main research objectives, a detailed subset of exploratory research questions was developed based on the literature review and the practice (secondary sources) [9]. This set of exploratory research questions offered the main categories of analysis that guided the semi-structured in-depth interviews to the managers and other decision-makers in the study, allowing for consistency and uniformity in data collection.

4 Qualitative Data Collection: In Depth Semi-structured Interviews

The qualitative study was developed through an interpretative approach of a combination of primary and secondary sources, using a thematic analysis [10]. Initially, secondary sources were examined, including diverse published material in the field and statistics. This step allowed clarifying the research problem and assisting in the construction and selection of the investigation paths. In a second phase, primary data was collected

through in-depth semi-structured interviews, directed to: agricultural managers, agricultural firms, owners, and public decision-makers. To perform the thematic analysis, we interpreted the narratives from the in-depth interviews in order to codify data and extract meanings and themes [9], in a deductive inductive thinking.

The interviews aimed to understand managers' experience and perceptions regarding aquaponics technologies for agricultural practices, the difficulties and limitations they are facing in the implementation of aquaponics businesses and identifying strategies of sustainable commercial aquaponics.

We interviewed five people connected to aquaponics, namely three businesspersons and two policy-makers - a mayor who is a supporter of this type of production and an engineer with responsibility at the governmental Institute for Nature Conservation and Forestry in Portugal (ICNF):

1. Participant 1 is a manager/owner of the start-up "Aquaponics Iberia", who has been working in aquaponics for some years.
2. Participant 2 is a manager/owner of one enterprise that produces aromatic herbs, that is a prototype for now.
3. Participant 3 is a manager/owner of an aquaponics test-production in horticultural.
4. Participant 4 is a researcher, PhD in Management, and the mayor of a town in the south of Portugal.
5. Participant 5 is an Engineer of ICNF in Portugal.

5 Results and Discussion

According to Participant 1, most consumers are very unaware of aquaponics and usually do not distinguish it from hydroponics. Participant 2 reinforces the idea, once agricultural professionals are not totally informed about what aquaponics are and even "the Ministry of Agriculture doesn´t know what this type of production is". However, Participant 5 refers there is a part of the population that is informed about what aquaponics is, although the normal consumer do not. Participant 3 corroborates in general this idea but adds that the existent consumer of aquaponics products is an enlightened and curious buyer.

Consumers are unaware that aquaponics is a sustainable agricultural practice, according to all of the respondents. Participant 1 says, "the main focus is to take the concept of aquaponics to the big consumer, valuing the concept, which at this moment does not happen because it is not certified like organic farming". Thus, it is difficult to pass the message to consumers because there is not a certification label to assign to the product.

In our country, according to Participant 3, there is no aquaponic production, there are homemade productions, there is no offer in the aquaponics market. His company found many legal obstacles, "we are still not producing as we wanted, we are still in a test phase" (Participant 3). All the farmers have the same perceptions on aquaponics practices, based on their knowledge and experience, as an innovative area and all their business are very recent.

Participant 2 started the business, in this case, a B2B business, in a low-scale production and one of the reasons is to explore customer acceptance of the product. He thinks that one of the advantages of this type of production is the diversity of products

that can be produced. It is also a sustainable practice, which saves water, guarantees the freshness of the products, and all this add value to agricultural production. Opinion shared by Participant 1, who also thinks that aquaponics is a sustainable practice in terms of environment, social, market-level and healthy food (because it is a natural and biological product).

Participant 4, on the other hand, believes that aquaponics will have a positive impact on both fish and vegetable markets, with consequences on economic growth, promoting the circular economy in several areas. In terms of environment, it is remarkable the reduction of waste and the sustainable way of production, which may be considered attractive by consumers. Participant 3 also shares the opinion that aquaponics promotes a sustainable way of production, because uses a reduced space and less water and other inputs.

Participant 1 considers that the retail markets are unwilling to pay the additional value for aquaponics products. The manager defends that the market does not exist yet, it has to be developed and consumers need to be informed about the product. There is a lot of illiteracy in Portugal related to aquaponics. It is necessary to develop and implement the first projects and create an appropriate regulatory framework (Participant 4).

Concerning how the firms develop actions and campaigns to promote their products, only the firm of Participant 2 sells its products to generate profits. This firm promotes its brand through the direct contact with customers by presentation and dissemination meetings on the concept and product. Accordingly to the entrepreneurs Participant 1 and Participant 2, the communication on and promotion of aquaponics products and practices should be made using different means, like exhibitions, where the concept can be seen and explained; presentations; events; training; workshops; presentations at schools (workshops to the students and teachers, encouraging the production of aquaponics, making their own production). Participant 1 also refers that he has trained hundreds of people, and a lot of them are domestic producers. Encouraging consumption through marketing campaigns, passing the message that aquaponics is a sustainable practice, presenting the concept at food fairs and exhibitions represent the best way to promote practices and aquaponics products in the opinion of Participant 3. Showing aquaponics as an alternative to the classical systems of production needs a good level of communication between producers and licensing entities that have the role to overcome gaps.

All the respondents share the same opinion regarding the gaps in the Portuguese legislation. The Decree-Law No. 565/99, December 21st, which regulates the introduction of exotic species, does not allow the introduction of many exotic species in Portugal, in contrast to what is happening in the rest of Europe. There are European directives that should be adopted by all European countries, which are facing restrictions in some of them because their legislation contradicts these directives, as it is the case of Portugal. These factors are an obstacle to national investment and even to other foreign investors, accordingly to Participant 1 and Participant 3.

6 Conclusion

The results of the in-depth interviews from aquaponics stakeholders seem to indicate that public local decision-makers, entrepreneurs and few young farmers are very motivated to

develop aquaponics in Portugal. Aquaponics is recognized by all as a sustainable practice. However, there are still strong institutional limitations that prevent the development of aquaponic at the commercial level, namely, the legislation gaps that condition the development of aquaponics and do not allow the full use of community funds to the Portugal 2020 from European Union. The results also show, according to the perception of stakeholders, that Portuguese consumers are still unaware of aquaponics products. For this reason, the development of marketing campaigns is recommended, as well as research in this topic. At an institutional level, we recommend more attention from public decision-makers to solve the main institutional restrictions to the activity in order to promote this innovative and sustainable way of food production.

References

1. Grunert, K.G., Hieke, S., Wills, J.: Sustainability labels on food products: consumer motivation, understanding and use. Food Policy **44**, 177–189 (2014)
2. Greenfeld, A., Becker, N., Bornman, J.F., dos Santos, M.J., Angel, D.: Consumer preferences for aquaponics: a comparative analysis of Australia and Israel. J. Environ. Manage. **257**, 109979 (2020)
3. Love, D.C., Fry, J.P., Li, X., Hill, E.S., Genello, L., Semmens, K., Thompson, R.E.: Commercial aquaponics production and profitability: findings from an international survey. Aquaculture **435**, 67–74 (2015)
4. United States Department of Agriculture, Rules and regulations, Organic. https://www.ams.usda.gov/rules-regulations. Accessed 24 Apr 2016
5. Junge, R., König, B., Villarroel, M., Komives, T., Jijakli, M.H.: Strategic points in aquaponics. Water **9**(3), 182 (2017)
6. Tamin, M., Harun, A., Estim, A., Saufie, S., Obong, S.: Consumer acceptance towards aquaponic products. J. Bus. Manage. **7**(8), 49–64 (2015)
7. Miličić, V., Thorarinsdottir, R., Santos, M.D., Hančič, M.T.: Commercial aquaponics approaching the european market: to consumers' perceptions of aquaponics products in Europe. Water **9**(2), 80 (2017)
8. Urban Farms: Urban Farms Project in Urban Agriculture (2017). https://urbanfarmers.com/projects/the-hague/. Accessed 26 July 2019
9. Dos Santos, M.J.P.L.: Smart cities and urban areas—aquaponics as innovative urban agriculture. Urban Forest. Urban Greening **20**, 402–406 (2016)
10. DePoy, E., Gitlin, L.N.: Introduction to Research-E-Book: Understanding and Applying Multiple Strategies. Elsevier Health Sciences (2015)

Factors Influencing Households' Intention to Adopt Solar PV: A Systematic Review

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Abstract. Rising energy needs, concerns of energy security, mitigating greenhouse gas emissions, climate change phenomenon and a push to utilize indigenous sources for energy generation purposes has encouraged the use of solar photovoltaics (PV). The technological advancements of the recent past, improvement in technologies' performance, reduction in the prices, policy and regulatory support, and its applicability at household level has made solar energy as a preferred form of energy generation. However, despite its rapid diffusion, it is widely believed that its current application is insignificant compared to its potential. This leads us to ask why solar PV has not been adopted to the level it should have. The existing literature has highlighted a number of factors affecting solar PV adoption. This paper systematically reviews the literature to identify the factors that have been instrumental to solar PV adoption. By exploring the Scopus database, this research identifies 39 articles matching the study objectives. Findings of this research will help academics, technology companies and policymakers in understanding the factors influencing the process and proposing solutions to address these.

Keywords: Adoption behaviour · Intentions to adopt · Barriers and facilitators · Systematic review · Solar PV

1 Introduction

The climate change phenomenon, the concerns of energy security and the issues associated with the conventional energy sources has triggered an inevitable need to transform energy sector. The existing energy infrastructure – energy production and consumption – has played an important role in the development of modern economies by assisting countries in meeting their primary energy needs. However, the rise in average global temperature, the increase in greenhouse gas emissions, sustainable use of conventional hydrocarbons and growing energy demand has highlighted the need to develop means through which the energy needs can be fulfilled without compromising the environment.

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The effective utilization of renewable energy sources renders an excellent opportunity to meet future energy needs in a sustainable and environmentally friendly manner [1].

Renewable energy sources has become a preferred choice due to their positive effects on the environment, their infinite nature and the role they can play in strengthening a county's energy security [2]. The development of latest technologies and a favourable policy regime has made it possible to efficiently utilize the available resources of energy generation purposes. REN21 affirms that the use of renewable sources in power generation has grown in recent years. Solar and wind energy alone have generated 151 GW electricity during 2018 [3]. An advantage that solar energy gets over other renewables is that in addition to commercial application, it provides individuals an opportunity to harness the potential for household purposes. A number of countries across globe are encouraging consumers to adopt this environmentally friendly mean of energy generation. The rationale behind the choice is that the self-production will reduces consumers' dependency on the grid electricity as well as the access energy can be transmitted back to the grid, thus offers an opportunity of becoming energy producer as well.

Despite the enormous potential and benefits, the utilization of solar energy at household level is less than desired. A number of studies have highlighted the factors affecting the diffusion of solar photovoltaics for household purposes. This paper systematically reviews the literature to identify the factors that have influenced solar PV adoption at household level.

2 Methodology

A successful systematic review is based on the clarity of the research question, keywords developed to assist the search, the databases explored to find relevant literature and researchers' ability to extract and present information in a manner that it highlight valuable insights to the readers as well as offers future research direction. Considering the objective of the paper i.e. to study the factors influencing intentions to adopt solar PV for household use, the following keywords were incorporated to ensure that the search extract desired articles. The keywords (factor OR factors OR antecedents OR drivers OR barriers OR impediments OR determinants OR traits) AND (affect OR affecting OR influence OR influencing OR examine OR examining) AND (intention OR intentions OR "intentions to use" OR use OR adoption OR "intentions to adopt" OR adopt OR accept* OR application) AND ("renewable energy technology*" OR "Solar energy" OR "Solar PV" OR "Solar Photovoltaic*" OR "Photovoltaics" OR "solar rooftop*" OR "rooftops") AND ("household" OR "home" OR "house" OR "private dwellings" OR "building"). The SCOPUS database was selected to search articles. The initial search yield 187 articles in total. The title, abstract and keywords were screened at the first phase to identify if the articles fits the criteria. In the cases, where initial screening did not provide sufficient information on inclusion or exclusion, full text was consulted to determine the eligibility. The final list included 39 articles. The list of articles is presented in the Table 1.

Table 1. Complete list of papers included in this review

No	Authors	Data collection*	Theory / Framework+	No	Authors	Data collection*	Theory / Framework+
1	Bach et al. [5]	INT	EnCF	21	Shakeel & Rahman [6]	SR	TPB
2	Mundaca & Samahita [7]	WSR	NA	22	Engelken et al. [8]	WSR	TPB
3	Kapoor & Dwivedi [9]	SR	DOI	23	Walta-s et el. [10]	FG	NA
4	Best et al. [11]	SR	NA	24	Bashiti et al. [12]	SR	NA
5	Alrashoud & Tokimatsu [13]	WSR	DOI	25	Qureshi et al. [14]	INT	DOI
6	Kastner & Wittaibarg [15]	SR, OB	SI	26	Dharshing [16]	PD	NA
7	Zanda- et al. [17]	SR	ChM	27	Jayaraman et al. [18]	SR	TPB
8	Arroyo & Carrete [19]	SR	GoFT	28	Briguglio & Formosa [20]	SD	NA
9	Abreu et al. [21]	SR	TPB	29	Baharoon et al. [22]	SR	NA
10	Lee & Hong [23]	SD	ABM, GIS	30	Kansal & Pathania [24]	SR	NA
11	Lu et al. [25]	SR	NA	31	Schaffa- & Brun [26]	SD	NA
12	Afroz et al. [27]	SR	NA	32	Palmar et al. [28]	SD	ABM
13	Graziano et al. [29]	SD	NA	33	Sigrin et al. [30]	SR	NA
14	Aggarwal et al. [31]	SR	TPB, UTAUT	34	Vasseur &. Kemp [32]	SR	NA
15	Tsaur & Lin [33]	SR	TAM, TPB	35	Sriwannawita & Laestadiusb [34]	INT, OB	NA
16	Wolske et al. [35]	WSR	NA	36	Kapoor et al. [36]	LTR	CnMD
17	Bondio et al. [37]	SR	DOI	37	Komatsu et al. [38]	SR	NA
I8	Srivastava & Mehendar [39]	SR	TPB	38	Schelly [40]	SD	NA
19	Rahut et al. [41]	SD	NA	39	McEachem & Hanson [42]	SR	NA
20	Jayaw eera et al. [43]	GIS	NA				

*INT (Interview's), WSR (Web-Survey), SR (Survey), OB (Obsavation), SD (Secondary Data), PD (Panel Data), LTR (Literature), FG (Focus group) +EnCF (Energy cluster framework), NA (Not Applicable), DOI (Diffusion of innovations), SI (Social influences), ChM (Choice Model), GoFT (Goal framing theory), TPB (theory of planned behaviour), ABM (Agent based model), GIS (Geographic informafion system), UTAUT (Unified theory of acceptance and use technology), TAM (technology acceptance model), CnMD (Conceptual model)

3 Results

3.1 Distribution

The 39 articles included in the review has been published in 23 different journals. Renewable and Sustainable Energy Reviews lead the publications with six articles followed by Energy Research and Social Science and Energy Policy with five articles each, whereas sustainability has published four articles. The publishing journal covered topics related to energy, policy matters, sustainability, social sciences, business studies and technology related issues. The earliest paper included in the review was published in the year 2008 while the latest paper was published as recently as January 2020, the month this review was conducted. The distribution of the publications suggests that almost 72% of the papers were published during 2017–2020 while 23% were published during 2013–2016 and only 5% were published during 2008–2012. The rising number of publications in the domain signifies researchers' interest in the field as well as highlights the importance of the subject in the recent times. This amplified interest can also be attributed to the recent advancement in solar PV in terms of technology's performance, reduction in cost, improvement in efficiency and the supportive policies the counties have adopted for the development and diffusion of renewable energy technologies. The analysis of geographical distribution reveals that around 38% of the studies were conducted in the Asian context followed by 23% and 15% in Europe and North America respectively. The country wise ranking reveals that the USA is the leading country with five articles, followed by Germany with four articles, whereas three articles were published in both India and Australia.

3.2 Methods

The analysis of methods reveals that the research done in this field has primarily been deductive in nature with over 80% of the papers employing quantitative methods. The two thirds of the quantitative studies have used survey questionnaires for primary data collection while the remaining 20% have relied on data collected by various national/international agencies or have used the information gathered through geographical information system. Three of the total five qualitative studies have used semi-structured interviews for data collection, while one study employed focus group approach, while the fifth paper proposed a conceptual model using secondary data.

The quantitative studies can be categorized into theoretical and atheoratical. The theoretical papers have relied on the established theoretical lenses rooted from innovation management, psychology and social sciences literature. An overwhelming majority of the studies have used theory of reasoned action (TRA), theory of planned behaviour (TPB), diffusion of innovations (DOI), technology acceptance model (TAM), and unified theory of acceptance and use of technology (UTAUT). These theoretical frameworks have been employed in multiple fields to study technology adoption in different contexts [4]. However, the review highlights that most of the studies have extended the original framework by integrating new variables or have combined two or more theories, or adopted their constructs to investigate the problem. The rational of combining theories/extending original framework has been to integrate new variables that could have an impact on the adoption of solar PV.

3.3 Factors Influencing the Adoption Behavior

This systematic review affirms that the adoption of solar PV can be influenced by a number of factors. The factors can be divided into demographic, personal, social, technical, economic and external factors. The demographic factors concern with individual's age, gender, education, occupation, income, marital status, house size, house type, number of residents, ownership status and condition of building. The personal factors refer to an individual' attitude towards the environment, interest in environmental issues, level of motivation, expectations, perceived benefits, knowledge about the technology, willingness to adopt, intentions and perceived behavioural control.

In addition to individual's personal attributes, the effect of social factors on the adoption behaviour is apparent. The scholars have studied this by considering if the neighbours have installed solar PV at their houses, the overall installation in the locality as well as effect of visibility and observability of the technology. The adoption is also found to be affected by the complex nature of solar PV, consumers' perceived ease of use, their understanding of its usefulness, compatibility, relative advantage, risks associated with the use and after-sale repair and maintenance services are some of the major technical factors. The economic considerations are found to be the most important factors influencing the adoption. The high cost of the technology, the amount needed to be paid up front, financing options, the return on investment, the saving it could yield during the life span of the technology and reduction in the energy bills are some of the factors have impact on the adoption. The external factors include the market price of energy, subsidies, the regulations building owners needs to comply with and incentives on installation of energy generation.

References

1. Lovins, A.: Reinventing Fire: Bold Business Solutions for the New Energy Era. Chelsea Green Publishing, Vermont (2011)
2. Shakeel, S.R.: Commercialization of Renewable Energy Technologies: A study of Socio-economic, Technical and Regulatory factors in Finland and Pakistan. Acta Wasaensia, vol. 430. University of Vaasa (2019)
3. REN21: Renewables 2019 Global Status Report, Paris (2019)
4. Chen, M.F.: Extending the theory of planned behavior model to explain people's energy savings and carbon reduction behavioral intentions to mitigate climate change in Taiwan-moral obligation matters. J. Clean. Prod. **112**, 1746–1753 (2016). https://doi.org/10.1016/j.jclepro.2015.07.043
5. Bach, L., Hopkins, D., Stephenson, J.: Solar electricity cultures: household adoption dynamics and energy policy in Switzerland. Energy Res. Soc. Sci. **63**, 101395 (2020). https://doi.org/10.1016/j.erss.2019.101395
6. Shakeel, S.R., Rahman, S.U.: Towards the establishment of renewable energy technologies' market: an assessment of public acceptance and use in Pakistan. J. Renew. Sustain. Energy. **10**, 045907(1–15) (2018). https://doi.org/10.1063/1.5033454
7. Mundaca, L., Samahita, M.: What drives home solar PV uptake? Subsidies, peer effects and visibility in Sweden. Energy Res. Soc. Sci. **60**, 101319 (2020). https://doi.org/10.1016/j.erss.2019.101319

8. Engelken, M., Römer, B., Drescher, M., Welpe, I.: Why homeowners strive for energy self-supply and how policy makers can influence them. Energy Policy **117**, 423–433 (2018). https://doi.org/10.1016/j.enpol.2018.02.026
9. Kapoor, K.K., Dwivedi, Y.K.: Sustainable consumption from the consumer's perspective: antecedents of solar innovation adoption. Resour. Conserv. Recycl. **152**, 104501 (2020). https://doi.org/10.1016/j.resconrec.2019.104501
10. Walters, J., Kaminsky, J., Gottschamer, L.: A systems analysis of factors influencing household solar PV adoption in Santiago. Chile. Sustainability **10**, 1257 (2018). https://doi.org/10.3390/su10041257
11. Best, R., Burke, P.J., Nishitateno, S.: Understanding the determinants of rooftop solar installation: evidence from household surveys in Australia. Aust. J. Agric. Resour. Econ. **63**, 922–939 (2019). https://doi.org/10.1111/1467-8489.12319
12. Bashiri, A., Alizadeh, S.H.: The analysis of demographics, environmental and knowledge factors affecting prospective residential PV system adoption: a study in Tehran. Renew. Sustain. Energy Rev. **81**, 3131–3139 (2018). https://doi.org/10.1016/j.rser.2017.08.093
13. Alrashoud, K., Tokimatsu, K.: Factors influencing social perception of residential solar photovoltaic systems in Saudi Arabia. Sustainability **11**, 5259 (2019). https://doi.org/10.3390/su11195259
14. Qureshi, T.M., Ullah, K., Arentsen, M.J.: Factors responsible for solar PV adoption at household level: a case of Lahore, Pakistan. Renew. Sustain. Energy Rev. **78**, 754–763 (2017). https://doi.org/10.1016/j.rser.2017.04.020
15. Kastner, I., Wittenberg, I.: How measurements "affect" the importance of social influences on household's photovoltaic adoption - a German case study. Sustainability **11**, 5175 (2019). https://doi.org/10.3390/su11195175
16. Dharshing, S.: Household dynamics of technology adoption: a spatial econometric analysis of residential solar photovoltaic (PV) systems in Germany. Energy Res. Soc. Sci. **23**, 113–124 (2017). https://doi.org/10.1016/j.erss.2016.10.012
17. Zander, K.K., Simpson, G., Mathew, S., Nepal, R., Garnett, S.T.: Preferences for and potential impacts of financial incentives to install residential rooftop solar photovoltaic systems in Australia. J. Clean. Prod. **230**, 328–338 (2019). https://doi.org/10.1016/j.jclepro.2019.05.133
18. Jayaraman, K., Paramasivan, L., Kiumarsi, S.: Reasons for low penetration on the purchase of photovoltaic (PV) panel system among Malaysian landed property owners. Renew. Sustain. Energy Rev. **80**, 562–571 (2017). https://doi.org/10.1016/j.rser.2017.05.213
19. Arroyo, P., Carrete, L.: Motivational drivers for the adoption of green energy: the case of purchasing photovoltaic systems. Manage. Res. Rev. **42**, 542–567 (2019). https://doi.org/10.1108/MRR-02-2018-0070
20. Briguglio, M., Formosa, G.: When households go solar: determinants of uptake of a photovoltaic scheme and policy insights. Energy Policy **108**, 154–162 (2017). https://doi.org/10.1016/j.enpol.2017.05.039
21. Abreu, J., Wingartz, N., Hardy, N.: New trends in solar: a comparative study assessing the attitudes towards the adoption of rooftop PV. Energy Policy **128**, 347–363 (2019). https://doi.org/10.1016/j.enpol.2018.12.038
22. Baharoon, D.A., Rahman, H.A., Fadhl, S.O.: Personal and psychological factors affecting the successful development of solar energy use in Yemen power sector: a case study. Renew. Sustain. Energy Rev. **60**, 516–535 (2016). https://doi.org/10.1016/j.rser.2016.01.004
23. Lee, M., Hong, T.: Hybrid agent-based modeling of rooftop solar photovoltaic adoption by integrating the geographic information system and data mining technique. Energy Convers. Manage. **183**, 266–279 (2019). https://doi.org/10.1016/j.enconman.2018.12.096
24. Kansal, B., Pathania, A.K.: Evaluation of consumer acceptance and satisfaction from solar energy products. Prabandhan Indian J. Manage. **9**, 45–52 (2016). https://doi.org/10.17010/pijom/2016/v9i12/107011

25. Lu, Y., Chang, R., Shabunko, V., Lay Yee, A.T.: The implementation of building-integrated photovoltaics in Singapore: drivers versus barriers. Energy **168**, 400–408 (2019). https://doi.org/10.1016/j.energy.2018.11.099
26. Schaffer, A.J., Brun, S.: Beyond the sun - Socioeconomic drivers of the adoption of small-scale photovoltaic installations in Germany. Energy Res. Soc. Sci. **10**, 220–227 (2015). https://doi.org/10.1016/j.erss.2015.06.010
27. Afroz, R., Tudin, R., Morshed, M.N., Duasa, J., Muhibbullah, M.: Developing a shariah-compliant equity-based crowdfunding model towards a Malaysian low-carbon consumer society. Malays. J. Consum. Fam. Econ. 22s2, 185–202 (2019)
28. Palmer, J., Sorda, G., Madlener, R.: Modeling the diffusion of residential photovoltaic systems in Italy: an agent-based simulation. Technol. Forecast. Soc. Change **99**, 106–131 (2015). https://doi.org/10.1016/j.techfore.2015.06.011
29. Graziano, M., Fiaschetti, M., Atkinson-Palombo, C.: Peer effects in the adoption of solar energy technologies in the United States: an urban case study. Energy Res. Soc. Sci. **48**, 75–84 (2019). https://doi.org/10.1016/j.erss.2018.09.002
30. Sigrin, B., Pless, J., Drury, E.: Diffusion into new markets: evolving customer segments in the solar photovoltaics market. Environ. Res. Lett. **10**, 084001 (2015). https://doi.org/10.1088/1748-9326/10/8/084001
31. Aggarwal, A.K., Syed, A.A., Garg, S.: Diffusion of residential RT solar – is lack of funds the real issue? Int. J. Energy Sect. Manage. (2019). https://doi.org/10.1108/IJESM-02-2019-0004
32. Vasseur, V., Kemp, R.: The adoption of PV in the Netherlands: a statistical analysis of adoption factors. Renew. Sustain. Energy Rev. **41**, 483–494 (2015). https://doi.org/10.1016/j.rser.2014.08.020
33. Tsaur, R.-C., Lin, Y.-H.: Exploring the consumer attitude of building-attached photovoltaic equipment using revised technology acceptance model. Sustainability **10**, 4177 (2018). https://doi.org/10.3390/su10114177
34. Sriwannawita, P., Laestadiusb, S.: Determinants of the diffusion of solar home systems: case study among low-income inhabitants in Bangladesh. Energy Environ. **26**, 803–816 (2015). https://doi.org/10.1260/0958-305X.26.5.803
35. Wolske, K.S., Todd, A., Rossol, M., McCall, J., Sigrin, B.: Accelerating demand for residential solar photovoltaics: can simple framing strategies increase consumer interest? Glob. Environ. Change **53**, 68–77 (2018). https://doi.org/10.1016/j.gloenvcha.2018.08.005
36. Kapoor, K.K., Dwivedi, Y.K., Williams, M.D.: Examining consumer acceptance of green innovations using innovation characteristics: a conceptual approach. Int. J. Technol. Manage. Sustain. Dev. **13**, 135–160 (2014). https://doi.org/10.1386/tmsd.13.2.135_1
37. Bondio, S., Shahnazari, M., McHugh, A.: The technology of the middle class: understanding the fulfilment of adoption intentions in Queensland's rapid uptake residential solar photovoltaics market. Renew. Sustain. Energy Rev. **93**, 642–651 (2018). https://doi.org/10.1016/j.rser.2018.05.035
38. Komatsu, S., Kaneko, S., Shrestha, R.M., Ghosh, P.P.: Nonincome factors behind the purchase decisions of solar home systems in rural Bangladesh. Energy. Sustain. Dev. **15**, 284–292 (2011). https://doi.org/10.1016/j.esd.2011.03.003
39. Srivastava, C., Mahendar, G.: Intention to adopt sustainable energy: applying the theory of planned behaviour framework. Indian J. Mark. **48**, 20–33 (2018). https://doi.org/10.17010/ijom/2018/v48/i10/132325
40. Schelly, C.: Testing residential solar thermal adoption. Environ. Behav. **42**, 151–170 (2010). https://doi.org/10.1177/0013916508327867
41. Rahut, D.B., Mottaleb, K.A., Ali, A., Aryal, J.: The use and determinants of solar energy by sub-saharan African households. Int. J. Sustain. Energy **37**, 718–735 (2017). https://doi.org/10.1080/14786451.2017.1323897

42. McEachern, M., Hanson, S.: Socio-geographic perception in the diffusion of innovation: solar energy technology in Sri Lanka. Energy Policy **36**, 2578–2590 (2008). https://doi.org/10.1016/j.enpol.2008.03.020
43. Jayaweera, N., Jayasinghe, C.L., Weerasinghe, S.N.: Local factors affecting the spatial diffusion of residential photovoltaic adoption in Sri Lanka. Energy Policy **119**, 59–67 (2018). https://doi.org/10.1016/j.enpol.2018.04.017

Service Design Under the Form of "Micro Public Benefit" Taking the Surplus Food Sharing App as an Example

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Abstract. In the Internet Era, unprecedented opportunities and challenges have been brought to the public benefit field. As a new booming form of public benefit, "micro public benefit" has broken the limitations and boundedness of traditional public benefit. Purpose of this paper is to apply the novel ideas of "micro public benefit" to the service design field. First, this paper compares and analyzes differences between service models of traditional public benefit and "micro public benefit". Then through case studies, the key points of "micro public benefit" service design are summarized. Finally, as an application case, a food sharing app is designed based on the key design points.

Keywords: Micro public benefit · Service design · Application

1 Introduction

Providing public benefit is a common and important theme in the service design domain. In the Internet age, the development of online "micro-public benefit" has subverted the entire model of public benefit. "Micro-Public benefit" is network public benefit activities proposed, disseminated, spread, and participated by means of social media platforms such as Weibo and WeChat [1]. The emerging of micro-public benefit shows the potential that "everyone can participate in public benefit" and "everyone is participating in public benefit", which will lead to the "butterfly effect" of public benefit [2]. Therefore, this paper aims to apply the novel ideas of "micro public benefit" to the service design field.

2 Service Models of Traditional and the New "Micro" Public Benefit"

The traditional offline model of public benefit has the characteristics of niche, closed and inefficient. Most of the charitable activities are carried out spontaneously by wealthy businessmen or celebrity stars [3]. The past donation mode is mainly based on the charity of celebrities and wealthy businessmen. The charity organization of the traditional public

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benefit process has formed a management and management relationship with the public. The advantage is that the process is simple and clear and easy to operate [4].

The current micro public benefit behavior is emerging in the background of development of social media, such as Weibo, WeChat. The information transmission has gradually changed from the traditional one-way transmission mode to the two-way interaction mode. The majority of Internet users are no longer passive recipients of information, but active information disseminators and sharers, and even information publishers. Now the development of micro-public benefit has created a new platform for public benefit undertakings, making public benefit fundraising simple and convenient, and making the activities of non-profit organizations open and transparent [5].

3 Case Study and Key Points of Applying Micro Public Benefit in Service Design

A successful case of micro public benefit is analyzed here (see Fig. 1): Gongyi Zhongguo, literally means " Public Benefit China", is an e-commerce shopping mobile application. It is initiated by the state-owned Bank of China under the Chinese government's targeted poverty alleviation strategy（精准扶贫）. On this platform, users can purchase agricultural products from poor areas to help farmers and participate in other kinds of public benefit activities [6]. Based on analysis of this application, we have summarized 3 key points of a successful "micro-public benefit" service design as below:

Fig. 1. logo of " Public Benefit China" app

1. Reduce the physical and spiritual threshold of public participation.
2. Provide innovative and diversified service forms and contents.
3. Guarantee the transparency of service and establish the foundation of public trust.

So how are these points are reflected in "Public Benefit China"?

3.1 Reduce Physical and Mental Barriers to Public Participation

Figure 2 shows the various types of donators on this app (see Fig. 2). We can find private participators, such as ordinary individuals, social organizations, as well as official participators, such as universities, central and state organs, and even local governments. The donation threshold is low and there is no age and status limit. It also reflects that "micro public benefit" is no longer the charity work of the rich, but a public benefit activity that everyone can participate in [7].

Fig. 2. Interface shows participaters of the "Public Benefit China" app

3.2 Provide Innovative and Diversified Service Forms and Content

"Public Benefit China" provides a variety of agricultural products purchase services as well as donation services.

For example, in terms of services of agricultural products purchase, the app has a function called "Big Love Supermarket (大爱超市)" with a list of names of poor areas (see Fig. 3). After clicking the names, users see specialty agricultural products of these places. Individuals and organizations can browse, choose whatever they want, and place an order at once. The service mode "Purchase = Help, Help = Feedback" is a mode innovation of targeted poverty alleviation in the public benefit field [8].

Fig. 3. Interface shows "Big Love Supermarket (大爱超市)" of "Public Benefit China" app

In addition, in terms of donation services, the platform organizes diversified activities targeted different groups of age, gender, or areas, such as donation for left-behind seniors/children,for region suffers typhoon and floods. Users can make direct donations them via the app (see Fig. 4).

Therefore, it can be seen that "Public Benefit China" app achieves innovation and diversity in the way of public service, bringing different participation experience to users [9].

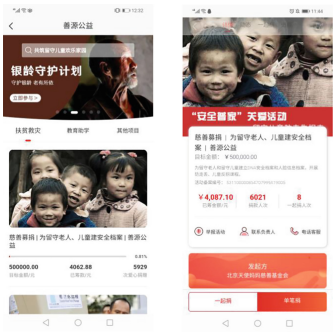

Fig. 4. Interface shows donation services of “Public Benefit China” app

3.3 Guarantee the Transparency of Service and Establish the Foundation of Public Trust

As shown in the Fig. 5, in this app, users can comment their purchased agricultural products and share their opinions; Meanwhile, they can also check authenticity of the seller, in terms of whether they are people being responsible for selling products of registered poverty-stricken counties and regions. Sellers must provide official certificate to prove their identity.

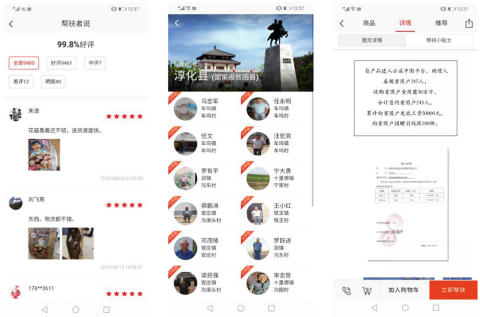

Fig. 5. Interface of checking authenticity of the seller.

These methods can increase the base of trust and ensure the transparency and openness of this service [10].

4 Real Case Application of Key Design Points

Based on the previous summarized point of applying the notion of micro pubic benefit in service design, we develop an application for sharing surplus food. The reason for we choose this theme is because of the severe situation of food waste in nowadays world and the feasibility of alleviating this problem [11]. This app provide a platform linking

supermarkets with food will expired soon and individual customers who want to buy food on discount.

So how do we apply these 3 key points to this application specifically?

4.1 Reduce Physical and Mental Barriers to Public Participation

This app is open to every supermarket and user and provide both online/offline shopping experience (see Fig. 6). Users can browse supermarkets that has joined Surplus food sharing APP and locate their nearby supermarkets through the location-based search (see Fig. 7). They can choose neither physically going to the supermarket nor purchasing online. The rapid development of the "Internet + public benefit" model makes the Internet information exchange fast, not limited by geography or time [12].

Fig. 6. Logo of Surplus food sharing APP

Fig. 7. Interface of browsing food and locating supermarkets

4.2 Provide Innovative and Diversified Service Forms and Content

The platform offers a "Lucky Bag (福袋)" program, as shown in Fig. 8. "Lucky Bag" is originated from a Japanese New Year custom in which merchants make grab bags filled with unknown random contents and sell them for a substantial discount. Therefore, the excitement of "Lucky Bag" is "surprise of not knowing and real bargain".

Based on this concept, in our app, at the end of the day, supermarkets put surplus food into bags and sell them at a discount price. in addition, the bags can be reused for holding things and booklets of cooking methods of food inside is put into the bag as well, so the customers can explore new ways of cooking. We also create an innovative service model of public benefit in the "Lucky Bag" program. When a customer buys 10 bags, the platform donates 1 bag to the poor on his/her behalf (see Fig. 9).

Fig. 8. Interface of finding lucky bags in supermarkets

Fig. 9. when the users buy 10 Lucky Bags, 1 bag will be donated to the poor

4.3 Guarantee the Transparency of Service and Establish the Foundation of Public Trust

As shown in the Fig. 10, surplus food sharing APP's donor interface is designed to be open to information. Users can click on any public benefit project, and each public benefit project will have a detailed introduction. There are also government departments that guarantee the effectiveness and safety of donations [13]. At the same time, users can share their donation information. The information disclosure of the network provides supervision, guarantees the transparency of the service and establishes the foundation of public trust [14].

Fig. 10. Screenshot of the interface of Surplus food sharing APP

5 Conclusion

Our research contributes to both theoretical and practical applications [15]. Firstly, the differences between traditional public service model and "micro public benefit" model are compared and analyzed. By studying the relatively successful micro-public welfare in the current market and their role to users, we summarized the characteristics of micro-public welfare in service design and we finally developed an application containing these characteristics for sharing surplus food. This app provide a platform linking supermarkets with food will expired soon and individual customers who want to buy food on discount.

References

1. Pu, Q., Zhang, W.: Study on the Development of Micro Public Benefit of Internet + . China Democracy and Law Press, May 2016
2. Kelly, K.: Inevitability, pp. 34–36. Publishing House of Electronics Industry, US (2016)
3. Hart, T.R.: Philanthropy: using the Internet to build support. Int. J. Nonprofit Voluntary Sector Market. 3 l-39 (2002)
4. Woodcraft, S., Hackett, T., Caistor-Arendar, L.: Design for social sustainability: a framework for creating thriving new communities. Future Communities (2011)
5. Jegou, F., Manzini, E.: Collaborative services: social innovation and design for sustainability. Milano: Edizioni POLI. Des. 137–138 (2008)
6. Gong, M., Manzini, E., Casalegno, F.: Mobilized collaborative services in ubiquitous network. In: Internationalization, Design and Global Development. Springer, Heidelberg (2011)
7. Ashford, N.: Level of service design concept for airport passenger terminals a European view. Transp. Plan. Technol. **12**(1), 5–21 (1988)
8. Pinhanez, C.: Services as customer-intensive systems. Des. Issues **25**(2), 3–13 (2009)
9. Cook, L.S., Bowen, D.E., Chase, R.B., et al.: Human issues in service design. J. Oper. Manage. **20**(2), 159–174 (2002)
10. Zomerdijk, L.G., Voss, C.A.: Service design for experience-centric services. J. Serv. Res. **13**(1), 67–82 (2010)
11. Herrmann, A., Huber, F., Braunstein, C.: Market-driven product and service design: Bridging the gap between customer needs, quality management, and customer satisfaction. Int. J. Prod. Econ. **66**(1), 77–96 (2000)
12. Goldstein, S.M., Johnston, R., Duffy, J., et al.: The service concept: the missing link in service design research? J. Oper. Manage. **20**(2), 121–134 (2002)
13. Sargeant, A., West, D.C., Jay, E.: The relational determinants of nonprofit web site fundraising effectiveness: an exploratory study. Nonprofit Manage. Leadersh. **18**(2), 141–156 (2007)
14. Kanter, R.M.: Supercorp: How Vanguard Companies Create Innovation, Profits, Growth, and Social Good, pp. 64–75. Grown Business (2009)

Financing of Social Housing Investments in South Africa

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Abstract. The right to adequate housing is enshrined in the South African constitution. Accordingly, social housing has been identified by the government as one of the strategic interventions to be pursued in the delivery of housing services to the poor. As public sector funds are limited, it is imperative to establish alternative mechanisms for financing social housing investments.

A multiple case study approach reviewed social housing investment with specific reference to how they were financed, the challenges faced and whether there would have been a benefit in using alternative means of financing. This was supported by a literature review as well as interviews with relevant stakeholders.

The results highlighted that funding for the sector is available primarily through government grants and loan funding from national and provincial DFIs. Private sector participants are willing to participate in the sector and have the resources to do so. Nonetheless, there are concerns from private sector participants around the regulatory framework and the availability of collateral on funding provided to the sector. Social Housing Institutions (SHIs) also noted that the SHRA should facilitate discussions on the development of '*social housing agreements*' with municipalities that enable access to land, provide waivers on bulk contributions and afford SHIs rebates on municipal rates and tariffs. Successful delivery of social housing is dependent on both the private and public sector, sturdy institutions and a functional regulatory framework.

Keywords: Social housing · Financing · South Africa · PPPs · Guarantee funds · Bond schemes · Structured finance · Tax incentives

1 Introduction

The right to adequate housing is enshrined in the South African constitution (Parliament of South Africa 1997). In the new democratic South Africa, the government has prioritised the right to housing and social housing has been formally identified as one of the key pillars in addressing this challenge (Department of Housing 2004). However, the economy is increasingly faced with a constrained budget public sector funds are limited. Therefore it is imperative that innovative and sustainable solutions to funding social housing investments be explored and implemented.

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2 Literature Review

2.1 Potential Impact of Social Housing in South Africa

Social housing is defined by the Social Housing Act of South Africa No. 16: 2008 (hereon referred to as the Social Housing Act) as "a rental or co-operative housing option for low to medium-income households at a level of scale and built form which requires institutionalised management and which is provided by social housing institutions or other delivery agents in approved projects in designated restructuring zones with the benefit of public funding as contemplated in the Act" (Parliament of South Africa 2008). It has the potential to address multiple socio-economic challenges. These include delivering spatial integration and restructuring of South African cities, catalysing urban re-generation and hastening local economic development whilst creating a safety net for citizens that neither qualify for free government housing nor can access mortgage financing (Department of Human Settlements 2005).

While real estate and infrastructure are key drivers of economic growth, conversely they can also contribute to the poor performance of the economy in locations where there is a lack of adequate infrastructure. This is particularly evident in previously busy and dominant urban areas, where poor maintenance, changing trends and socio-economic factors result in businesses relocating to desirable locations elsewhere (Nel 2001). The impact of this urban decay can have a debilitating effect on the local economy of an area through a loss of revenue to the local authority, high unemployment and increasing crime. However, through urban regeneration and gentrification, local authorities have the means to reverse the trend of urban decay and create vibrant growing cities (National Association of Social Housing Organisations (NASHO) 2012).

Social housing provides local authorities with a means to densify cities and locate populations in areas with existing infrastructure, minimising the need for new infrastructure (National Association of Social Housing Organisations (NASHO) 2012). As it is ideal for low to middle-income groups with constrained incomes, it means that this demographic could constitute a ready-made labour force which can lure businesses back to the city (Samara 2005), while adding revenue to local authorities through rates and taxes.

Social housing can play a role in addressing inequality by providing a safety net for the poor (National Association of Social Housing Organisations (NASHO) 2012). At low-income levels, housing and transport costs constitute a significant portion of a household's budget. They are closer to economic opportunities and do not allocate a significant portion of their household budget to transport costs which then allows them to allocate more funds to education and healthcare (Swilling 2006).

2.2 Social Housing Financing Model Applied in South Africa

While social housing investments are developed and managed by private entities (both for-profit and non-profit companies), a sizeable portion of the funding comes from government (The Government of the Republic of South Africa 2012). The remainder of the project financing will have to be sourced from either debt or equity and relies on the financial strength of the social housing project sponsor. Loan financing is likely to come

from commercial banks and DFIs which charge market rates. This type of commercial funding is often inappropriate both in terms of tenure and pricing for SHIs, more so new entrants. It is these funding challenges that are highlighted as hurdles in the delivery of social housing projects (Centre for Affordable Housing Finance in Africa 2012). The Social housing funding structure in South Africa consists of capital grants (55%–60%), Debt portion (25%–30%) and Equity (10%).

2.3 Shortcomings of Financing Social Housing in South Africa

2.3.1 Supply-Side Constraints

Growth in the social housing sector has meant that there is an ever-increasing number of social housing projects requiring funding from the SHRA. To address these social housing projects limit the number of units which negatively impacts the economies of scale a social housing project can achieve and net operating income generated. This compromises sustainability in the long run (Centre for Affordable Housing Finance in Africa 2012).

Furthermore, the subsidies provided result in the SHRA retaining the first mortgage bond in the event of default. As this is contractually binding on the SHI and is also catered for in the Social Housing Act, a conflict arises as commercial lenders the mortgage bond that a lender would register against the property typically does not recognise the SHRAs right as espoused by the Social Housing Act (Centre for Affordable Housing Finance in Africa 2012).

2.3.2 Demand-Side Challenges

Credit risk is a concern in social housing given that the target market for this type of housing is already financially constrained, making them more susceptible to default. Financial institutions highlight this risk as one of the key reasons for the lack of appetite in financing social housing projects, especially as they require expert tenant and property management (Centre for Affordable Housing Finance in Africa 2012).

Social Housing tenants are allocated units based on their income bands. These bands are determined as per the gazetted legislation. Both bands (primary and secondary) at present do not increase with inflation and this becomes a challenge when a tenant leaves the unit. At this point, the SHI is required by law to replace the vacated tenant with one whose income is within the gazetted income bands. This may not be financially feasible as the rent would have increased by inflation over the years (Centre for Affordable Housing Finance in Africa, 2012). In this instance, the SHI is required to reduce the rental to accommodate the new tenant or pay back the subsidy to the regulator. This is not financially feasible as it results in a misalignment of income and costs impacting the ability of the SHI to repay their debt obligations. Commercial property is attractive from a lenders perspective in that annual escalations are often guaranteed in the lease agreements. Therefore lenders are assured of an increasing annuity that can be used to repay the debt. In the absence of this, lenders view the social housing project as being riskier and will either charge a higher interest or not provide debt funding (Colwell and Park 1990).

2.4 Alternative Financing Mechanisms for South Africa

The models discussed below are applied in countries where the social housing sector is mature and stable relative to South Africa. The models may provide an alternative to the challenges posed above.

2.4.1 Public-Private Partnerships (Model 1)

The UK social housing sector is similar to the South African social housing sector in that there exists state support in the form of capital grants. In 2014, these constituted approximately 25% of the total project cost. The remainder is sourced from private sector funding with state-funded subsidies contributing a small portion. This "Public-Private" financing model seems to be adaptable to macro changes in the economy due to the collaborative effort of both the public and private sector (Williams and Whitehead 2015). Such a model may be suited to the South African context.

2.4.2 Bond Schemes (Model 2)

In Austria, the bulk of funding for projects is sourced from sales of specialised bonds known as Housing Construction Convertible Bonds (HCCB). These bonds are issued by designated Special Purpose Vehicles (SPVs) known as Housing Banks who operate within a pre-determined legislative criterion to ensure that operating costs are minimised (CECODHAS Housing Europe 2009). Such innovative bond schemes provide incentives for investors and preferential regulatory charges for participating institutions thereby crowding in commercial funding.

2.4.3 Guarantee Funds (Model 3)

The Dutch social housing sector has a three-tier collateral structure where the first two structures act as "Guarantee Funds". The first tier is the Central Housing Fund (CFV) a public entity whose role is to monitor the financial and operational performance of housing institutions. The second is the Waarborgfonds Sociale Woningbouw – Social Housing Building Guarantee Fund (WSW) an institution created by the housing institutions with a single capital injection by the state for the purpose of facilitating access to financing at favourable interest rates. The final one is the state (local authority and national government), who in the event that the first two tiers are unable to assist, step in on an equal basis to bail out the institution (CECODHAS Housing Europe 2009). A similar system would strengthen the social housing sector in South Africa from a financing perspective.

2.4.4 Tax-Incentive Driven Model (Model 4)

All models applied in Austria, England, Netherlands and France, in particular, have an element of state support through the use of tax incentives. These models include the use of tax-free savings accounts, rebates on VAT, municipal taxes for social housing investments and tax-breaks for institutional investors who provide funding for social housing. Such "Tax-incentives" could be applied in the South African context (CECODHAS Housing Europe 2009).

2.4.5 Structured Finance Model (Model 5)

The Austrian model in its entirety is made up of equity from developers of social housing units, state-sponsored supply-side subsidies and specialised bonds that offer investors incentives and favourable commercial loans. Through this bespoke "Structured Finance" model, Austria has managed to achieve an inclusive housing sector with quality accommodation for close to the entire population while maintaining public sector expenditure within the average of peer European countries (Amann and Mundt 2010). Further analysis is warranted to determine which elements may be applicable in South Africa.

3 Research Methodology

A multiple case study approach was employed, where selected social housing investments were reviewed with specific reference to how they were financed, the challenges faced and whether there would have been a benefit in using alternative means of financing. This was supported by a literature review on the subject of financing of social housing investments in different countries as well as interviews with stakeholders who are involved in the activities and processes related to the financing of social housing investments in South Africa.

4 Data Analysis and Results

A total of 10 semi-structured interviews with participants from the social housing sector were conducted and participants were grouped into four categories based on their roles.

Regulator Perspective
The interviews highlighted that model 1 was viewed as a viable alternative financing mechanism. This was primarily based on the fact that the current funding model already had elements of a PPP. Furthermore more, model 4 was also considered an option as it can also be combined with model 1, particularly where the municipality can assist with the provision of land and preferential rates and taxes for social housing projects.

Private Funders
Private funders asserted that model 5 is currently the model being applied in social housing for projects that qualify for private funding with the only differences being the limited collateral as lenders are not permitted to dispose of the property in a default scenario. Model 1 was considered an alternative depending on the strength of the cash flows. Model 3 was also viewed as an attractive proposition as it would address the issue of collateral upon default. However private funder participation would depend on the terms and conditions tied to the guarantee.

Development Finance Institutions (DFIs)
The main theme from the participants emphasized that the current model which has elements of model 1 and is largely structured in the same way as model 5 was the best alternative. Opportunities to improve the efficiency of the funding process did exist,

primarily with respect to collaboration between the Regulator and DFIs and having a more formalised engagement. Both were of the opinion that models 2 and 3 were not as appropriate as model 1 and 5, however, the one participant noted that model 2 may be feasible if it was implemented on a larger scale which at present is not possible as the sector is small.

Social Housing Institutions (SHIs) and Industry Organisations
Participants responded positively to model 4, highlighting that benefits which included a waiver of bulk contributions during developments and rebates on tariffs and municipal taxes would enhance the current financing model. Similarly, model 1 enjoyed the support of all participants with the exception of one participant that was concerned about the interference of municipalities in operational matters. This resonated with the SHIs general view that a clear and concise framework should be developed where the benefits accruing to social housing projects are clearly articulated and roles and responsibilities defined when implementing model 1. Participants were least supportive of model 3 noting that the state was already supporting the sector extensively and that the guarantee fund should rather be set-up to support growing SHIs and be capitalised by larger SHIs that have received state support in the past.

5 Conclusion

It was established that while funding for the sector is available, Private Funders have not participated in the sector for a number of reasons which include, but are not limited to restricted collateral conditions on loans advanced, restrictive regulations and poor delivery capacity.

Stakeholders interviewed were of the view that SHRA should play a central role in the establishment of '*social housing agreements*' that clarify roles and responsibility and ensure better collaboration between stakeholders. In this regard consistency of application as it relates to the rules, obligations and rights was identified as a key reason for the preference toward such a model.

References

Parliament of South Africa: The Constitution. Parliament of South Africa (1997)
Department of Housing: "Breaking New Ground" A Comprehensive Plan for the Development of Sustainable Human Settlements, pp. 1–42 (2004)
Parliament of South Africa: Republic of South Africa Social Housing Act (16) (2008)
Department of Human Settlements: Social Housing Policy. Environment, 44, May (2005)
Nel, E.: Local economic development: a review and assessment of its current status in south. Africa **38**(7), 1003–1024 (2001). https://doi.org/10.1080/00420980120051 61
National Association of Social Housing Organisations (NASHO): Social Housing as a Driver of Urban Regeneration - Potential and Constraints Report on Social Housing and Urban Regeneration Workshops 2012. Social Housing and Urban Regeneration Workshops 2012, pp. 1–51 (2012). http://www.nasho.org.za/wp-content/uploads/2012/03/NASHO-SH-UR-Workshops-Report-lo-res.pdf

Samara, T.R.: Youth, crime and urban renewal in the western cape. J. South. Afr. Stud. **31**(1), 209–227 (2005). https://doi.org/10.1080/03057070500035943

The Government of the Republic of South Africa: Social Housing Regulations, vol 9669, pp. 1–48 (2012)

Centre for Affordable Housing Finance in Africa: Opportunities for private sector investment in social housing in South Africa (2012)

Colwell, P., Park, H.: Seasonality and size effects: the case of real-estate-related investment. J. Real Estate Econ. **3**, 251–259 (1990). https://www.researchgate.net/profile/Peter_Colwell/publication/5151761_Seasonality_and_Size_Effects_The_Case_of_Real-Estate-Related_Investment/links/570423d708ae44d70ee05fab/Seasonality-and-Size-Effects-The-Case-of-Real-Estate-Related-Investment.pdf

Williams, P., Whitehead, C.: Financing affordable social housing in the UK; building on success? Housing Finance International, pp. 14–20 (2015)

CECODHAS Housing Europe: Financing social housing after the economic crisis, vol. 46 September 2009

Amann, W., Mundt, A.: The Austrian System of Social Housing. Business. Vienna (2010). https://www.researchgate.net/profile/Wolfgang_Amann2/publication/37390965_The_Austrian_System_of_Social_Housing_Finance/links/54d8ccb00cf2970e4e795559.pdf

Research on Urban Waste Service System Based on Shanghai Waste Classification

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Abstract. On July 1st, 2019, Shanghai officially launched a series of institutional arrangements related to garbage classification. According to statistics, the proportion of participation is less than 20%. The choice of garbage classification in Shanghai has become an obligation that must be performed, which is an inevitable result of the development of society. Therefore, this study aims to improve the Shanghai municipal waste service system from the perspective of user experience. The design of the thesis consists of the following three steps:

(1) Investigate current municipal waste services. (2) Develop a model for urban waste services through service system design methods. (3) Tools for service system design include accompanying observations, questionnaire surveys, personas, stakeholder maps and other practices for the design of urban waste service systems. This design considers the optimization of urban waste systems with a service design method, which has certain reference significance for urban development and sustainable development.

Keywords: Garbage classification · Service design · Sustainable design · Urban development

1 Background

Driven by the economic philosophy of exponential growth in consumerism, the availability, complexity, and rapid manufacturing of consumer goods are creating highly unsustainable levels of "waste" output. These all point to the urgent need to reshape how waste is managed [1].

In the 20 years of the 21st century, China's huge economic and social increase has also brought an increasing amount of waste. Urbanization, population growth, and industrialization are the three main reasons for the substantial increase in China's total waste production [2]. However, the waste classification and the collection method is a waste source treatment method commonly used in developed countries. In the past, China has mainly collected waste by mixed waste collection and then processed it through simple landfill and direct incineration. Such a treatment method not only occupies a large

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number of land resources, but also generates harmful gas and permeate, which causes serious pollution to the environment, at the same time, it is easy to breed mosquito and fly along with the bacteria, and there is a potential threat of spreading infectious diseases [3]. Relevant data shows that China's waste accumulation is about 6 billion tons, and it is in a continuous upward trend, and China's development has brought unprecedented growth in waste. The 18th National Congress of the Communist Party of China has proposed a series of new concepts, new ideas and new strategies centered on Xi Jinping's ecological thinking. Promoting garbage classification is the only way for China to promote the construction of ecological civilization, and it is also an important goal for government departments to improve urban life.

2 Urban Waste System

Since July 1st, 2019, Shanghai has promulgated the "most stringent" domestic waste management regulations. After advocating it for more than 20 years, Shanghai took the lead in incorporating garbage classification into the legal framework and established China's strategy for achieving sustainable development. Researcher Liu Xinyu said, "The significance of this legislation is to transform the past voluntary environmental protection actions into legal obligations that every citizen should fulfill." [4]. Waste collection refers to the activity of transferring the waste from the main disposal site to a treatment plant. In order to determine the selective collection system, it must be considered There are many important technical, economic, environmental, and legal factors related to the place where the event takes place [5]. Therefore, there is no single, universal policy that applies to all cities. Given this, this article also only addresses the Shanghai Municipal garbage classification System Discuss with policies in-depth, and only for reference to other cities.

2.1 Figures Regulations of Shanghai Municipality on the Management of Domestic Waste

The regulations clearly define the responsibilities of all parties in the formulation: garbage producers, management responsible persons, government departments, collection and disposal units, social organizations, etc. A clear classification standard, incentive and punishment systems are established simultaneously, a "green account" reward mechanism is set up, fines are imposed for mixed operation of garbage, and fixed-point fixed-time household garbage is implemented for residential communities and enterprise units [6].

2.2 Garbage Classification Policies in Other Countries

2.2.1 Garbage Classification in Japan

Japan's meticulous waste classification also originated in the 1970s, and the long-term dependence on a large number of waste incineration treatments had a huge impact on Japan's environment.

In 2000, Japan clarified the responsibilities that governments and companies have assumed as citizens for garbage disposal and set various A special bill.

In addition, Japan has compiled detailed classification manuals and guides. The Japanese government also attaches great importance to environmental education for primary school students. Therefore, Japan has formed an environmental protection education system mainly led by the government and supplemented by social responses [7].

2.2.2 German Garbage Classification

At the beginning of the 20th century, Germany began to advocate the implementation of waste separation by citizens. High recovery and recycling rates can be attributed to the following four aspects:

1. Using economic leverage to curb waste production [8].
2. The management system of the government and state-owned enterprises, garbage is the government's public resource, and the government is also a reliable guarantee to solve the problem of garbage.
3. Strict rule of law: The strictness of law enforcement for the illegal disposal and classification of garbage in accordance with regulations has also strengthened the self-discipline of citizens.
4. PET deposit refund system. This is a deposit that the German government is levying on recyclable materials.

3 Methodology of Product Service System Design

The international environment and growing user demand have encouraged companies to innovate discover new business opportunities. Under this circumstance, in the past two decades, many companies have linked services to their offline products in order to create benefits for customers. This is called Product Service System (PSS) [9]. Morelli modified the logical design sequence used by Ulrich and Eppinger for service design. The PSS design process includes value acquisition, market analysis, product service system definition, usage analysis, solution modeling, testing, and final system definition in a total of seven stages [10].

In view of the problem of urban waste, during the past time and practice, scientific research has also tried to find technical solutions from smart garbage classification equipment, promulgated related policies and laws and propagated through different media channels. However, the user's feelings were ignored. This article mainly proposes the following service design models based on the studies of the above scholars: Define requirements—system role analysis—service system construction—service system design—evaluation and optimize the design of the processes of urban waste service.

4 Urban Waste Service Design and Process Exploration

4.1 Definition Stage

The definition stage includes determining the target user, user needs, user pain points, and design goals. The design methods include: accompanying observation method, questionnaire synthesis method, and building a persona model. The research method uses qualitative and quantitative methods to deeply explore the user's pain points and demand.

4.1.1 User Research

Accompanying the observation method is one of the methods of user research in service design, which aims at a more intuitive collection of information such as the research environment and social environment. In the design of the urban waste service system, researchers define the problems of residents in the community during the garbage disposal process as well as recording unconscious behaviors and problems.

Based on this, a questionnaire was made, aiming to have a deep understanding of the garbage classification of 50 residents.

4.1.2 Demand Analysis

The questionnaire population was concentrated between the ages of 28 and 45. Through the survey data, it was found that 84% of Shanghai residents currently have some sorting problems in garbage classification, of which 73% of the users finally guided the classification through online platforms and searched online for information on waste classification.

After comprehensive understandings of the questionnaire surveys and in-depth interviews, the user needs are summarized into the following four points:

Information acquisition—auxiliary waste treatment—feedback channels—material rewards.

4.1.3 Persona

According to the analysis of the data results in the previous user research, the user group is roughly divided into three groups: including office workers who live alone, housewives of three families, and garbage managers in community services. Different characteristics of people have different needs and service scenarios. The garbage classification of the three types of users is summarized through character analysis along with their needs and expectations. It includes classification guidance for spam information, convenient or knowable location information, strict regulatory windows. There are also ways to increase user satisfaction: feedback channels for waste disposal, on-site service for domestic waste, and convenient access to reward mechanisms.

4.2 Service Scenario Analysis

The service scenario analysis of urban garbage service design is mainly applied to the design tools of user journey maps. Visualize the user's complete experience of behavioral

processes and the goals they expect to accomplish in a specific time and space. The touch-points resulting from user and service contacts constitute a completed journey.

4.2.1 Analysis of Contact Points in the Waste Sorting Process

Due to the diversification and non-continuation of the classification policy process in Shanghai, most residents are confused about the type of waste and affected the enthusiasm of residents. The instability of the policy not only caused a waste of policies and social resources but also affected residents' trust in the government. Besides, the dissemination of classified information is also relatively limited and lacks consideration of actual application scenarios. The lack of residents' knowledge of garbage classification has also greatly affected the enthusiasm of user participation. Garbage sorting facilities are the basic conditions for implementation. The lack of sorting bins in public areas has greatly reduced residents' enthusiasm.

4.2.2 User Journey Map

Draw the persona model on the user journey map, sort out the key factors that affect the user experience, and come up with five opportunity points to achieve a better urban waste service system, including guidelines for garbage classification, a positioning system for waste equipment, assisted garbage disposal and recycling and positive feedback window (Fig. 1).

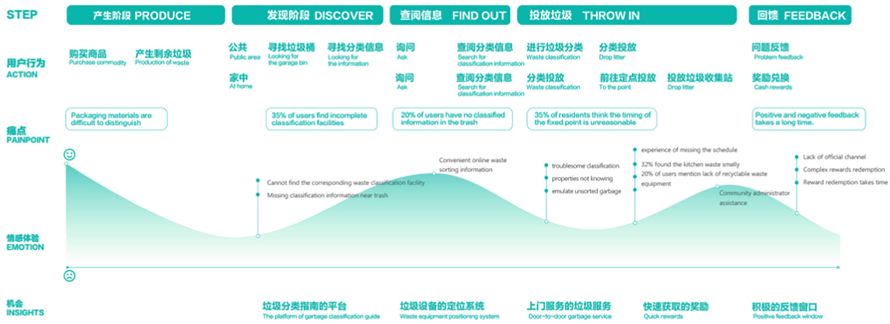

Fig. 1. User journey diagram of urban garbage.

4.3 Service System Construction

One of the characteristics of service design is the systematic nature of the design, including design objects, interaction methods, and related cooperative roles. These include service recipients, service providers, users, platforms, governments, merchants, garbage managers, recycling companies, waste treatment plant. Set up focus groups to discuss and draw a visual chart of the interests between these groups. The service process is centered on the urban waste service platform to achieve circulation between various service

system modules. Users realize their needs through the platform and get rewards and provide feedback. The platform receives funds from brand partners to promote and reward users. The government provides financial assistance to garbage recycling companies and brand partners and provides equipment support to recycle garbage data provided by enterprises. The platform analyzes user life data for the government. It helps to realize the concept of sustainable development, build a green city together and enhance the sense of social responsibility of residents (Fig. 2).

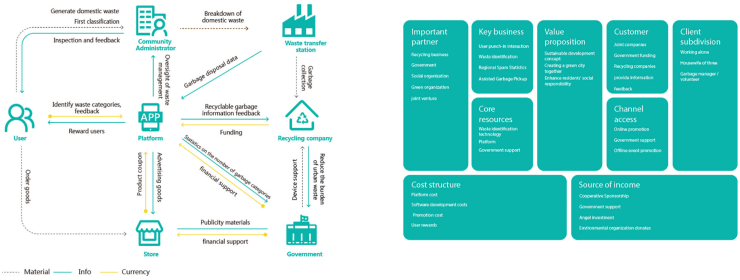

Fig. 2. Stakeholder map.

4.4 Service System Design

4.4.1 Construction of Urban Waste Service System

Based on the analysis of the problems, needs, and opportunity points mentioned above, the five major function points of the service system platform are summarized: information query, garbage service, entertaining, green data and recommendation evaluation. And the concept of divergence is carried out in the form of focus groups. That is how we build the following app functional architecture.

4.4.2 Service Platform Design

In the design stage of the city garbage service app, the main color adopts a light and bright green gradient to match the user's psychological expectations for sustainable green behavior. The functions are mainly search guides, appointment garbage pickup services, fun education, and personal data management (Fig. 3).

4.5 Test

Usability test

Usability testing is based on iterative design. By using interactive prototype testing software to conduct usability testing of the design solution, it guides the target user and the designer to evaluate the design. During the testing process, the user's touch points, hesitation, hidden requirements in the test and feedback evaluation are taken into consideration and recorded.

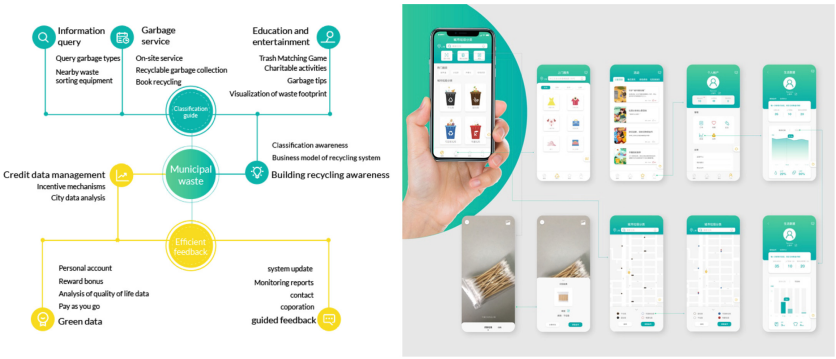

Fig. 3. Urban waste service platform design.

Ten volunteers were selected for testing. The volunteers generally expressed their surprise and satisfaction with the garbage image and voice recognition functions, the trash can positioning function and the number of gold coins in the personal account were the main points of interest for users. And they also expressed expectations of the functional area of analysis of quality of life through garbage data.

On the technical level, users mentioned how to measure the wet waste, and whether the on-site service standards meet the scope of the user's responsibility, and whether the waste disposal enterprise can achieve commercial closed loop with human, material and government subsidies.

Finally, the information in the test is combed and analyzed, and the problems and deficiencies in the service process are modified and improved.

5 Conclusion

It will take a long time in Shanghai to realize the goal of reducing waste, garbage classification, and sustainable development, regardless of policies, systems, and technologies. The main reason for this is that it takes a long-term process to cultivate people's bottom-up awareness of garbage classification. This article mainly uses the design method in the service system design from the perspective of improving the user experience to gain insight into the problems and opportunities in the classification and treatment of municipal waste and builds a service system that meets the needs of users and the government system under the Shanghai municipal waste classification system. However, it lacks a certain amount of technical support and there are still some shortcomings in improving satisfaction. In general, Shanghai's garbage classification system has room for development and it also provides a certain reference value for the cultivation of awareness of urban garbage classification and the implementation and optimization of policies.

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References

1. Rootes, C.: Environmental movements, waste and waste infrastructure: an introduction. J. Environ. Polit. **18**(6), 817–834 (2009)
2. Zhang, D.Q., Tan, S.K., Gersberg, R.M.: Municipal solid waste management in China: status, problems and challenges. J. Environ. Manage. **91**(8), 1623–1633 (2010)
3. Liu, M.: The waste classification experience in developed countries and its enlightenment to China. J. Southwest Univ. Nat. (Hum. Soc. Sci.) **32**(10), 98–101 (2011)
4. http://www.xinhuanet.com/politics/2019-06/24/c_1124661157.htm
5. Rada, E.C.: Effects of MSW selective collection on waste-to-energy strategies. J. WIT Trans. Ecol. Environ. **176**, 215–223 (2013)
6. https://k.sina.com.cn/article_3164957712_bca56c10020013jdf.html
7. Lv, W., Du, J.: Japan's waste classification management experience and its enlightenment to China. J. Central China Norm. Univ. (Hum. Soc. Sci.) **55**(1), 39–53 (2016)
8. Rencai, Luo, Ying, Zhang: Research on classification method of German municipal solid waste. J. China Resour. Compr. Util. **26**(7), 30–31 (2008)
9. Manzini, E., Vezzoli, C.: A strategic design approach to develop sustainable product service systems: examples taken from the 'environmentally friendly innovation' Italian prize. J. Clean. Prod. **11**(8), 851–857 (2003)
10. Morelli, N.: Product-service systems, a perspective shift for designers: a case study: the design of a telecentre. J. Des. Stud. **24**(1), 73–99 (2003)

Dictionary of Competencies for Sustainable Development in the Municipalities of Northern México

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Abstract. The present research work has the purpose of identifying which are the key elements within the municipal governments in Mexico, which could be considered as the most significant areas of opportunity whose strategic attention would be a better performance in the fulfillment of their constitutional attributions, in the promotion of public policies capable of integrating the realities of its inhabitants and their communities, but also capable of incorporating into them actions and commitments derived from national and global agendas, also playing with the above, a more active role in the scene international contributing successful experiences in its institutional work.

Keywords: Municipal government · Sustainable development · Local development

1 Introduction

From the existing bibliography, which exposes the current situation of disadvantage in which the municipal governments in our country have been found, and the variety of reasoning that reflects the need to find the different causes of this weakening, there are exogenous elements and endogenous, which must be identified and analyzed to be able to measure in their fair dimension how they have impacted on the institutional capacities of municipal structures and especially on their results. Within the exogenous elements, due to its level of importance for the main objective of this investigation, since it has been considered as the main factor of the negative or positive impact on the institutional results of the governments in Mexico [1], and particularly on the municipal governments, is the historical-cultural scheme of the centralization of public resources and certain institutional policies that derive from other instances of authority. For which, this work is intended to capture this dynamic in general, to know its level of impact on the operation of municipal governments and municipalities in general. It is about identifying and demonstrating that within the institutional powers of municipal governments there are additional elements that could be used to make a proposal for improvement. To this end, the focus is then on the endogenous elements of the same municipal structures,

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of which the own strengths that arise from their constitutional powers and their own resources (human and non-human) are considered for this investigation, as well as other strengths and advantages of the municipalities.

2 Framework

While in the international arena [2] the global dynamic evolves vertiginously towards large-scale and even survival objectives of the communities, with the Sustainable Development approach, which proposes a holistic articulation between social development with economic and environmental development, and an Agenda Global, "the 2030 Agenda" that includes seventeen Sustainable Development Goals (SDGs) [12].

This Agenda despite having already been signed and ratified by the Mexican State since 2015, has international commitments that are hardly intended to be fulfilled due to lack of proposals that include municipalities as key elements of these inclusion processes, and in these commitments, and where the internal dynamics of their own at the national level are often the main causes of this omission, but other times they are the same limited capacities of those who direct these planning and execution processes in municipal governments.

The Global Agendas [3] are currently far removed from the Municipal Agendas. The most serious thing is that the main reason for this divergence is due to ignorance of its existence. Indeed, currently those who make up the municipal governments in their vast majority continue to ignore the 2030 Agenda and the SDGs. Or they simply perceive it as commitments that must be fulfilled by other levels of government, not by municipal authorities. Although SDG issues seem not to be the responsibility of the municipal sphere, the fact is that they are of concern, and of the responsibility of any human being, and those who integrate municipal governments in turn seem not to be aware of this concern.

In Mexico [4] most governments, especially at the municipal level, face conditions of electoral temporality, of commitments established and conditioned by other levels of authority, with interests that are often not necessarily those of the momentum of the development of their communities, lacking knowledge and vision regarding the functioning of the public administration, and do not say on the issues of Development. Paradoxically, municipal governments have become "entities of immediate reaction" because they are the closest spaces to their citizens. But also, those who receive all the concerns of problems generated by other institutional entities, but also the proposals for the solution of a citizenship to which they are also due, and with which they committed. A citizenship, which is their biggest criticism, but also, if incorporated into decision-making, can be your best ally. That is why this research will propose innovative citizen participation mechanisms, as another of the key elements in strengthening the institutional capacities of municipal governments.

The great advantage unlike state [5] national and even government governments does not say international organizations. It is also in the municipalities, where it is for this reason, that the importance of seeking a strategy that addresses this is the one that is closest to the citizens is highlighted and its most important function is reflected in being the "eternal managers" before the levels superiors of authority, investing most

of their time in these tasks. And it is of little use if a new ruler arrives at the head of the municipality, with leadership, knowledge and vision, when he does not have the budget, or the trained team of suitable public servants, with the knowledge, experience and vision necessary to be able to Design Municipal Development Plans according to the new realities of the increasingly informed society and of an increasingly demanding citizenship of the behaviors and results of their governments.

3 Model and Methodology

This research is based on the tools provided by INAFED and ADM. And specifically, in the work carried out in the five municipalities during the years 2016, 2017, and 2018, during which, the ADM Program, was the only one that so far has been able to address throughout the country along with municipalities, issues related to their performance, directly identifying the relevant aspects of the municipal issue. From the Typology defined in the DCS, the Dictionaries of Labor Competencies (DCL), the Dictionaries of Professional Skills (DCP) and the Dictionaries of Research Competencies (DCI) will be generated; where in each of them the evaluation of product satisfaction is established according to the initial objectives by the Technical Committee (TNM-ITT), before being delivered to each participating Institution. Currently, Labor Skills Standards have been established by CONOCER from level 1 to level 5 (UNESCO-ISCED), this proposed methodology includes the development of Professional and Research Competencies at levels 6, 7 and 8 corresponding to the bachelor's level Master and Specialization, and Doctorate. The definition of the Typology of the Dictionaries of Sectorial Competencies requires establishing a DCS Typology, for which the development of a Technical Committee (specialists) that follows up the Planning stages is contemplated, Project Development and Evaluation, being staff of the institutions that will make up the Certification and Evaluation Entity (ECE). The methodological basis for the definition of the DCS is the Fifth Systemic Helix QHS [6], which requires the participation of the representatives of the different sectors involved such as Government, Education, Business, Associations-Clusters and Consultants-Society; for the development of this methodology, it is necessary to consider and include the analysis of the competitiveness indicators, which are the pillars that affect each sector, thereby identifying the variables that affect and good regional, national and international good practices; as well as the explicit consideration of public policy programs that affect the strategic sector in question to add and align efforts to identify and close the sector gap between the present and the ideal considered in the National Development Plan.

For the advancement and fulfillment of the SDGs, the participation of municipal governments is essential even though they are not explicitly in their constitutional powers in the limited Article 115 [7]. The different instances can support and contribute to the achievement of the agenda objectives national and also global, as is the case, but above all it is your responsibility to do so. In almost all SDGs, [8] such as climate change and its effects, care of the environment, care of the seas and rivers, care and sustainable use of water, guarantee access to sustainable energy, guarantee sustainable consumption and production modalities, equality Among the genders, including sustainable cities, etc., the municipalities can collaborate and include actions within their planning [9]. in some

of a limited way, but in the vast majority definitely the municipal structures can do much more, as long as the Areas of opportunity for institutional strengthening.

Currently in Mexico [10], there is no strategy that while a global agenda permeates very slowly, and of which several are not described or included in any plan or program and that are of human survival, resulting from true very complete research processes, strengthen the means of execution, and revitalize the global alliance for sustainable development. Of paramount importance, for this investigation, since in order to understand the dynamic so wide within which the municipalities perform, and that it could be considered as a "hybrid between endogenous and exogenous", it is the subject of coordination mechanisms inter-governmental organizations, for which the National Institute for Federalism and Municipal Development (INAFED) [11], and its work in Baja California with the five municipalities are considered.

4 Conclusions

From the structure and information of the Municipal Development Agenda (ADM), implemented in Baja California, the basis for the design of the methodology of this research emerges, as its fundamental objective. Regarding the design of a new Development Model in the municipalities, it is sought at all times to propose a model that serves as a guide to be able to design the municipal development plans and that can at the same time serve as the new model must have a global vision and municipal, articulated, sustainable development, which incorporates in addition to the powers of an anachronistic Article 115 Constitutional, harmonize and articulate coherently and holistically, an orientation towards Sustainable Development.

The holistic articulation between the social, economic and environmental level, which involves the care of the environment, drives agendas where the great themes of survival and development of all the communities in the world are incorporated, such as the Sustainable Development Goals (SDG), in our country, the visions continue to be short-term, largely ignoring governments at their different levels of authority, continuing to implement policies of government work, which when it is especially inverted is the key, risky but realistic, the global agendas can mainstream the MDGs, and become mandatory principles, together with human rights, the objectives of the peoples are relevant, if it is about the survival of humanity, and be a responsible society, with future generations. Municipal governments in an anachronistic federalist scheme, and a simulated autonomy, between cultural aspects and centralism, municipal governments have to survive and depend.

From the ADM methodology, the concept related to Institutional Development, Planning and Environmental Care is fundamentally rescued, to propose the methodology that will be used in this research, and will address the internal and external vision in the policy analysis of issues of public administration and public policy where the planning of the territory becomes one of the two most important elements of the Municipal Development Model that is intended to be proposed.

When considering the complexity of the municipal scenario in Mexico, in terms of its sociodemographic, cultural, geographical, regulatory, etc. characteristics, likewise, in terms of an operational reality, this investigation considers as a case the five municipalities of Baja California: Tijuana, Mexicali, Ensenada, Tecate and Playas de Rosarito.

For which, the results generated later will be used through the QHS Methodology define the institutional methodology to identify the AST (Situational Work Analysis) and carry out in parallel the Skills Sector Studies in the different strategic sectors with the purpose of designing the Case Studies as teaching material for the Dictionaries of Sectorial Competencies (DCS) and their respective Dictionaries of Labor Competencies (DCL), Professional Competencies (DCP) and research (DCI); with the purpose of achieving an impact on competitiveness and innovation from Technological Higher Education and sector competitiveness according to the strategic axes of the National Development Plan 2018–2024. The proposed requirements for certification processes are presented in Table 1 as a first approach to the product of this applied research.

Table 1. Proposal of requirements for certification processes

Certification level	*Labor, professional and research*							
Requirements	1	2	3	4	5	6	7	8
Education						✓	✓	✓
Experience						✓	✓	✓
Training	✓	✓	✓	✓	✓	✓	✓	✓
Precertification						5	6	7
Professional ID						✓	✓	✓
Postgraduate ID								✓

References

1. Constitución Política de los Estados Unidos Mexicanos. Articulo 115. [fecha de consulta 30 de enero de 2010]. Disponible en. http://www.diputados.gob.mx/LeyesBiblio/pdf_mov/Constitucion_Politica.pdf
2. Instituto Nacional para el Federalismo y el Desarrollo Municipal. Disponible en. https://www.gob.mx/inafed
3. The Global Competiviness Report 2019. World Economic Forum. Disponible en. http://www3.weforum.org/docs/WEF_TheGlobalCompetitivenessReport2019.pdf
4. Estudios económicos de la OCDE. México 2018. OCDE. Disponible en
5. https://www.gob.mx/shcp%7Cgacetaeconomica/documentos/estudios-economicos-de-la-ocde-mexico-2019-ocde
6. Presentación del Estudio Económico de México 2019. OCDE. Disponible en. https://www.oecd.org/economy/2019-economic-survey-of-mexico-may-2019-sp.htm
7. Martínez Gutiérrez, Rodolfo, Quinta Hélice Sistémica (QHS), un método para evaluar la competitividad internacional del sector electrónico en Baja California, México. Investigación Administrativa [en linea] 2012, (Julio-Diciembre): [Fecha de consulta: 20 de agosto de 2019] Disponible en: http://www.redalyc.org/articulo.oa?id=456045338003, ISSN 1870-6614
8. Articulo 115 de la Constitución de los Estadidos Unidos Mexicanos. https://www.gob.mx/inafed/articulos/24-de-enero-de-1917-se-aprueba-el-articulo-115-constitucional-que-instituye-el-municipio-libre-en-mexico

9. Preparando a las entidades federativas para la competitividad: 10 mejores prácticas. Gómez MacFarland Carla A. (2017). Los planes de desarrollo municipal en México y la participación ciudadana. Un análisis del marco jurídico. Boletín Mexicano de Derecho comparado. Scielo. Disponible en. http://www.scielo.org.mx/scielo.php?script=sci_arttext&pid=S0041-86332017000301149
10. León Guzmán, F.: La Planeación del Desarrollo Municipal en México. Disponible en. https://www.gestiopolis.com/planeacion-desarrollo-municipal-mexico/
11. Revuelta Vaquero, Benjamín (2013). Acciones Locales de Impacto Global en Mexico. Scielo. Disponible en. http://www.scielo.org.mx/scielo.php?script=sci_arttext&pid=S1870-21472013000200010
12. ONU. Objetivos de Desarrollo Sostenibles[Fecha de la Consulta 29 de enero de 2010]. Disponible en: https://www.un.org/sustainabledevelopment/es/2015/09/la-asamblea-general-adopta-la-agenda-2030-para-el-desarrollo-sostenible/en cuanto a una realidad operativa, esta investigación considera como caso a los cinco municipios de Baja California: Tijuana, Mexicali, Ensenada, Tecate y Playas de Rosarito

Mining Industry

Filling Method Implementing Hydraulic Lime for Reusing Mine Tailings and Improve Sustainability in Conventional Peruvian Underground Mines

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Abstract. Mining in Peru has existed for several decades, and for several years, there has been no proper environmental management of the impact of this activity on the environment and society in general, whether it be gas emissions, the presence of acidic water, or the generation of mining tailings. One of the most prominent examples involve mine tailings; these are by-products of mining processing plants and are stored in a dam known as a tailings dam. Like any extraction activity, mining generates large amounts of waste material that could become potential risks to the environment and society. Using hydraulic fills, the mine tailings contained in tailings dams could be reused. These fills seek to decrease the volume of stored tailings to prevent any future dam collapses, as observed in Brazil with the Vale mining company, where its tailings dam collapsed and caused more than 200 deaths.

Keywords: Mining tailings · Hydraulic filling · Hydraulic lime · Mine closure

1 Introduction

This Currently, there are approximately 9000 environmental liabilities in Peru, which have been produced by mining activities. However, owing to technological advances, many mining companies have stopped using conventional techniques to mechanize mines. Thus, the use of modern equipment with clean energy is incorporated in their processes, resulting in less negative impact on the environment, not only within the mining operation but also in the processing plant. This is where mining tailings from unused materials are originated prior to being sent to a tailings dam. In the past, tailings were deposited in places near the processing plant without considering socio-environmental

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factors. They were simply stored within the earth's crust with no social, environmental, or legal control. This generated a high rate of contamination, which is currently being remediated to reduce their impact. However, Law 17752, Chapter II, Section 22 states the following: "Discharging or emitting any waste, whether solid, liquid, or gas, that may contaminate waters, causing damage or endangering human health or the normal development of the flora or fauna by compromising their use for other purposes is hereby strictly forbidden". In accordance with the guidelines put forth by the Energy and Mining Sector Policy, 1995, the Peruvian Government shall guarantee private investment but that the conditions of respect for the environment within the mining-energy sector are met thereby promoting the preservation of the environment in areas of intense energy-mining activity to maintain an ecosystem that is suitable for the development of life.

2 State of the Art

In the mining industry, two types of exploitation methods can be identified: underground and open-pit methods. In the underground method, the mining cycle is comprising drilling, blasting, cleaning, transport, loading, support, and filling, wherein filling is the final stage of the mining cycle for any underground mine. There are different types of fillers: cemented filler, paste filler, detrital filler, and the best-known hydraulic filler. Paste filler requires the presence of slurry to maximize the solid content [1, 2], as its fine particles reduce the need to use large amounts of water. Furthermore, the water used here does not need to be drained because it is consumed when hydrating the cement.

There are several terms associated with lime, both current and historical, which can generate some confusion when referring to lime plasters and mortars. Understanding the difference between hydrated lime and hydraulic lime appears to be, by far, the most challenging distinction for most people. The prefix "hydrated" is a good clue that reveals that both terms are related to water. First, hydrated lime is produced when limestone is burned to produce lime, releasing CO2 gas. Second, hydraulic lime has the property of hydraulicity, since they do not have any type of additive such as cements and have much more resistance than a hydrated lime.

Hydraulic fillings favor production increases owing to the increase in efficiency rises by saving time when filling the cuts. In addition, the use of conventional equipment for transporting fillers is eliminated because only pipes would be used, these pipes are considerably cheaper and faster than conventional equipment. The main hydraulic filling factor that influences the sustenance is the hydraulic filling that forms a uniform floor, which helps to make the slab sustainable and usable in the next sublevel of exploitation. It begins to fill the pit and look for the appropriate level of height, so that it is then allowed to dry for several days. And good support was obtained [3, 4].

Currently, in Peruvian mines, tailings are part of the mining and ore concentration processes. However, most of them contain elements that impact the environment. Therefore, they must be reused, transported, and stored in dams, where their components eventually settle at the bottom and the water is evaporated and recovered. Over time, they have been reused in different mines to reduce their impacts [5, 6]. In most cases, mine tailings are applied as hydraulic fillers. This process comprises obtaining mine tailings that are produced from the concentrator plant and transferring them to a hydraulic

filler plant where they are sorted based on the particle size [7]. The use of tailings as hydraulic fillers is a more resistant and economic technique for supporting exploitation works.

3 Collaborations

A new filling variant includes applying hydraulic lime to the traditional hydraulic fillers to generate a new type of mining filler because filling is a critical activity during the mine closure stage in the mining industry. Mine closure can be defined as the set of activities to be implemented throughout the life cycle of the mine to comply with specific environmental criteria and achieve the desired social objectives subsequent to the mining stage. It is a progressive process that begins in the first stage of the project with the conceptual design and ends only when the specific closure objectives have been permanently achieved [9].

Mine closure is crucial for mining companies, and Peru has a mine closure law that requires all operating mining units and projects to prepare and submit their corresponding mine closure plans. The law also establishes that the mine owner must issue a bond to cover mine closure costs, including possible long-term treatment and post-closure monitoring activities [10].

In addition, there are two types of mine closures: temporary and progressive closures. The progressive closure is a scenario that simultaneously occurs with the operation stage of a mine when components or part of a component of the mining activity is no longer useful. As a result, it must be subject to closure activities such as demolition, filling, and revegetation. Therefore, filling is a key element within progressive closures. The temporary closure is when all operations within the mine are closed, and the mine begins its final closing stage. Within this context, a new hydraulic filling design model would receive considerable attention from mining companies owing to the inclusion of hydraulic lime, which reduces the acidic water generated during the filling stage [11].

The application of hydraulic lime as a raw material for hydraulic filling is an innovative method and would be the first instance wherein this filler variant would be used in a Peruvian mine. The method originated as an idea to reuse mine tailings, which have been considered an environmental problem for several years. Therefore, mine tailings will be reused along with the hydraulic lime [11].

The proposed method repurposes mine tailings discarded by the mining concentration plant and is supported by the technical parameters of the mine tailing properties that are to be used as raw materials for hydraulic filling. To make mine tailings available for hydraulic filling, the quantity of tailings available from the same concentration plant and their quality must first be determined. Simultaneously, the volume of the tailings dam is reduced, thereby preventing future collapses (Fig. 1).

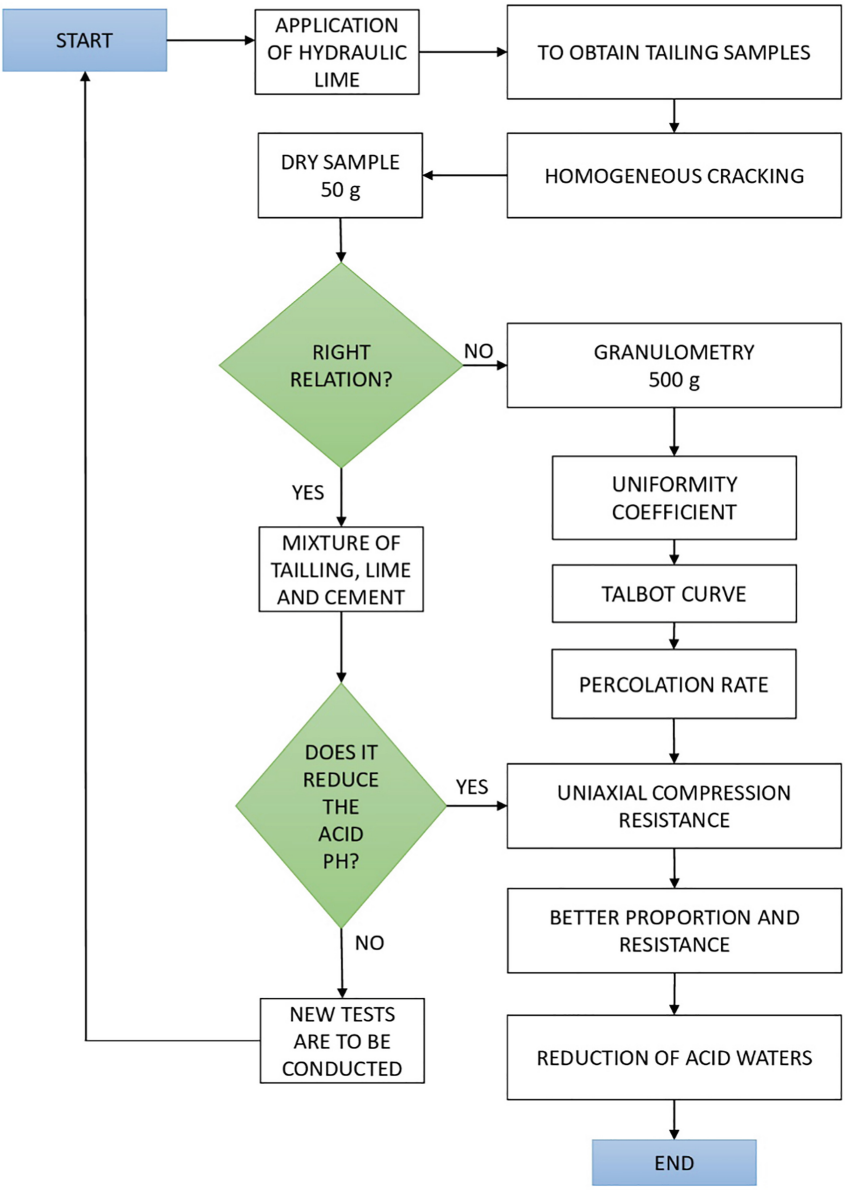

Fig. 1. Applied methodology

4 Validation

4.1 Case Study

The application of hydraulic lime will be performed at the Santa Filomena mining company, located in the city of Arequipa, Peru. This company is one of the primary gold

producers in the country. The company currently has large quantities of mine tailings and has not determined the correct way for reusing them. In addition, they use a type of debritic filler to support their exploitation works. The mining company produces 2560 tons of mining tailings per day, which means that for every 500 tons of ore extracted, 2560 tons are obtained [3].

4.2 Initial Diagnosis

The Santa Filomena mining company exhibits the following local geology: where igneous and volcanic rocks emerge and there is residual soil on the surface as a result of the intense weathering to which the rocks that emerge in this area have been subjected. The igneous rocks that constitute the foundation of the concession are composed of intrusive Granodiorite, Diorite, and Tonalite rocks with medium-to-thick grain consolidations. These rocks can be seen in the fields, constituting the mountain mass where mineral gold structures are housed, implying that no samples are obtained from nearby lime quarries. Therefore, hydraulic lime will be obtained from local suppliers [12].

The method is chosen based on the mineralization and the deposit properties of the Santa Filomena mine site. The mining method used in the mining company is the "Selective Upward Cut and Fill", with a mining capacity of 900–1000 tons per month (this tonnage varies based on the extraction performed by the different mining units), filling with the sterile material obtained from the mining pits to meet mining width standards.

It is worth mentioning that preparation works of the galleries and chimneys are performed over the veins, and therefore, certain preparation works are also performed as exploration works, implying that the ore may already be recovered in these stages (Table 1).

Table 1. The stability of the initial slash

Family	Orientation	Spacing	Aperture	Disturbance	Filling	Roughness	Persistence
1	175/55	20 cm	0.1–1.0 mm	slightly altered	Lasted >5 mm	Slightly rough	3 m
2	276/40	25 cm	1-5 mm	moderately altered	Soft <5 mm	Rough	8 m

4.3 Results

Based on the results, simple comparisons and analyses were made with the data:

To conduct hydraulic filling with an adequate dosage of cement–hydraulic lime - and to avoid high costs, the rock mass was characterized using Bieniawsky 1989 Rock Mass Rating (RMR) system.

In the "Santa Filomena" mining unit of the SOTRAMI S.A. company, it could be observed and analyzed that the rock is good; therefore, it does not require much support. The data obtained in the mining unit regarding the properties of the rock families to make the corresponding RMR are displayed below (Table 2).

Table 2. Talbot curve

um	%Accumulated tailings	Talbot	Mesh
2000	99.84%	45.82%	10
150	59.9%	12.55%	100
75	20%	8.87%	200

5 Conclusions

The application of hydraulic lime filler offers several advantages, such as reduced costs, increased productivity, and operational safety.

The RMR at the Santa Filomena mining unit is 61–65, which demonstrates a good quality of rock mass. Therefore, the cement and hydraulic lime will not be evenly distributed within the mixture for the planned support [13].

The specific gravity of the tailings from the Santa Filomena mining unit was 3.2, with a pulp density of 2.06 g/cm^3 owing to the high presence of pyrite in gold tailings.

The tailing percolation rate results obtained at the Santa Filomena unit are 2.25 cm/h, and the sedimentation rate is 4.03 cm/h.

The Talbot's curve reveals that the tailings from the Santa Filomena mining unit have many fine grains, which would not be the desired material because it prevents adequate water percolation and water removal would be time consuming. Therefore, it would take time to allow the staff to re-enter the pit.

Four tests were performed. In one of them, hydraulic lime was added in a 2:1 ratio with the cement; however, this did not generate a higher resistance to simple compression as expected. However, at the optimum ratio of 1:1, 10110 kPa was obtained; this value was three times that of the next highest resistance. Similarly, the pH level of the 1:1 cement and hydraulic lime test is 11.55, the highest among all the tests, followed by 11.20, obtained from the cement and tailings only test.

Fig. 2. Final result of PH

The application of hydraulic lime leverages 40%–50% of the tailings produced from the mining activities, which implies a longer lifespan for the current tailings dam, thereby reducing the negative environmental impacts and increasing the profitability of the mining company (Fig. 2).

References

1. Eason, G., Noble, B., Sneddon, I.N.: On certain integrals of Lipschitz-Hankel type I volving products of Bessel functions. Phil. Trans. Roy. Soc. London. **247**, 529–555 (1955)
2. Clerk Maxwell, J.: A Treatise on Electricity and Magnetism, vol. 2, 3rd edn, pp. 68–73. Clarendon, Oxford (1892)
3. Beltran, W.: Estudio Experimental de relleno hidráulico en mina Atacocha (2014)
4. Cantori, O.: Método de Relleno Hidráulico en Unidad Minera San Rafael (2016)
5. Fahey, M., Helinski, M., Fourie, A.: Some aspects of the mechanics of arching in backfilled stopes. Can. Geotech. J. **46**(11), 1322–1336 (2013)
6. Fiscor, S.: Evitando que el Costo de Almacenar Relaves se Convierta en una Desventaja (2013)
7. Turpo, E., Torres, Y.: Optimization of plant species and chelating agents in Phytoextraction of gold from small-scale gold mine tailings. Nat. Environ. Pollut. Technol. **15**(3), 1083–1088 (2013)
8. López, A., Barettino, : Estudio experimental de la respuesta geo mecánica de relaves en pasta cementados utilizados para el relleno de caserones. Obras Y Proyectos **17**, 6–12 (2002)
9. Sivakugan, N., Veenstra, R., Naguleswaran, N.: Int. J. Geosynth. and Ground Eng. **1**, 18 (2015). https://doi.org/10.1007/s40891-015-0020-8
10. Stone, D: The evolution of paste for backfill. In: Proceedings of the 11th international symposium on mining with backfill: mine fill 2014, Australia, pp 31–38 (2014)
11. Sivakugan, N., Rankine, K.J., Rankine, R.M.: Permeability of hydraulic fills and barricade bricks. Geotech. Geol. Eng. **24**, 661–673 (2006)
12. Webb, P.: Hydrated Lime vs Hydraulic Lime (2018)
13. Rankine, K.J., Sivakugan, N., Cowling, R.: Emplaced geotechnical characteristics of hydraulic fills in several Australian mines. Geotech. Geol. Eng. **24**, 1–14 (2006)

A Cyanide Tailings Management Method Using Pseudomonas Fluorescens to Improve Conventional Treatments for Progressive Closure at Small Gold Mines

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Abstract. Based on the review of different research studies, we could assess that, due to their unique biological features, microbes, specifically bacteria, could be used to repair damaged soils with heavy metal and toxic compound contents. Furthermore, these microorganisms are metabolically capable to oxidize cyanide and its by-products to generate less-toxic compounds at the end of the process. This research proposal seeks to improve conventional mine closure designs, thus counteracting their negative short-term, medium-term, and long-term after-effects to the environment. The proposed technique as a solution, therefore, is microbial remediation, using pseudomonas fluorescens bacteria to oxidize this compound to non-toxic components. It will ensure operational continuity for the deposits and, in turn, the sustainability of the entire mining industry.

Keywords: Pseudomonas fluorescens · Tailings · Cyanide · Gold mining · Mine closure

1 Introduction

The mining industry is an extractive activity that generates large amounts of waste from its processes. For example, the increasingly-popular metal recovery process produces approximately 7 gigatons (Gt) of tailings every year around the world as a by-product from ore extraction and refining activities [1]. In the case of gold mining, the cyanide (CN) leaching method is commonly used because it can dissolve the gold and achieve recovery in large percentages. Due to their high toxic content, the tailings generated from refining, however, must be carefully managed.

Currently, gold tailings are processed in open fields or deposits and are designed considering high safety and engineering parameters to protect the physical integrity of

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the workers and the surrounding environment [2]. In these deposits, tailings are treated with compounds such as peroxymonosulfuric acid (H2SO5), also known as Caro's acid, hydrogen peroxide (H2O2), and other market-available compounds to achieve chemical neutralization. Still, some cases have been reported where fractures in tailings deposits, or other issues, have caused serious contamination problems due to the significant toxicity percentages found in gold tailings. Since the treatment usually fails to completely eliminate CN, any tailings spill could cause irreparable damage [3].

In Peru, a large percentage of mines, from craft to large scale mining, are dedicated to gold production. They, therefore, are also dedicated to using CN in mass, thus directly affecting the problem of CN, mercury, and other toxic waste contamination. The by-product is CN tailings, which, in many cases, do not meet the permissible treatment parameters, contributing to the generation of short-, medium- and long-term environmental risks. The most affected departments include Madre de Dios, La Libertad, and Cajamarca, where 96% of gold mining takes place [4].

Further, the chemical and physical methods used for treating CN tailings pose large risks when closing down the tailings deposits because CN toxicity, currently, cannot be eliminated in full, which generates harmful aftereffects that affect the entire mining industry.

Given this reality and through the literature review, using pseudomonas fluorescens bacteria as a possible alternative solution emerged. It will help to minimize the effects or damage generated by using CN in the recovery of metals, mitigate the existing risks, and improve the management of CN tailings disposals.

2 State of the Art

The cyanidation process used for extracting gold and silver generates environmental impacts because of the treatment methods currently implemented for treating tailings or effluent waste. CN tailings are treated in several ways such as physical and chemical procedures. In the last few decades, the biological approach, however, has become popular.

To manage CN tailings at small mines, effluents are thickened, filtered, and recirculated to minimize their negative effects. This system, however, still exhibits shortcomings since it shows risks in the geotechnical and chemical stability of the solid content [4]. In other words, tailings management requires techniques that could contribute to reducing tailings infiltration by controlling deposit designs and coverages through compacted geomembranes [2].

Using microbes such as bacteria to treat CN tailings is based on their metabolic capacity to effectively degrade CN. The correct microorganisms must be selected according to their ability to degrade CN compounds and for their ability to tolerate additional stresses and other heavy metals that might be present in tailings [5]. Bacteria can decompose and eliminate CN using different degradations, but this depends on the microorganisms selected and their enzymatic ability. For example, pseudomonas pseudoalcaligenes CECT5344, and other similar cyanotrophic bacteria can assimilate and degrade high toxic CN contents [6]. At a gold mine in Kuala Lipis, Pahang, Malaysia, the pseudomonas pseudoalcaligenes strain was favorably isolated from mining wastewater and

used to quickly and effectively degrade CN. In this sense, the pH levels in alkaline conditions are critical for bacteria development and the subsequent CN biodegradation since acidic conditions foster HCN generation. The bacteria turn into ammonia, thus achieving a 60% degradation of CN [7]. Another study was conducted at a gold ore processing plant in Antioquia, Colombia. Here, gold tailings samples were analyzed with significant amounts of CN at concentration levels from 100 to 1000 ppm. The microbial treatment using the native P. fluorescens strain was performed at room temperature, and similar oxygenation and humidity conditions to the study area, resulting in the efficient and affordable removal of CN. The final CN results were 700 mg/l (700 ppm), which represents a 70% degradation from the initial tailings [8].

Most progressive tailings field closure plans focus on safe design, geomembranes, and geotextile waterproofing or structure stabilization, and long-term tailings encapsulation. Tailings are usually stored properly, applying rational and economically viable technologies to protect the physical integrity of people, the environment, and surrounding socio-cultural habitat. Closure or final disposal systems, however, are often executed under conventional mechanisms where waste is distributed for landfills or confined within the deposit, seeking to preserve the physical and hydraulic stability of the materials [2, 9].

Using biological processes to treat CN tailings has been increasingly studied in the last few decades due to the capabilities exhibited by bacteria for removing and degrading multiple pollutants, turning them into less toxic byproducts. For example, microorganisms can effectively decompose CN to acceptable environmental levels. Through aerobic processes, the pseudomonas fluorescens bacteria can oxidize CN, thiocyanate, nitrite, and ammonia to form nitrates, while, in an anaerobic environment, the bacteria turn these compounds into gas [10]. Microbial activity significantly influences the chemical and physical properties of tailings and accelerates soil development rates, which is essential for progressively managing tailing in mine closure processes. Microbial activity breaks the conventional treatment system for the tailings generated by the mining industry. The application of microbial consortia or different bacterial strains and the acclimatization of the native communities improve the degradation rates in tailings from gold mining and other industrial effluents. Likewise, any added nutrients provide a holistic vision, which improves compression for the mechanisms involved in biodegradation processes. Furthermore, the composition and dynamics of microbial populations will contribute to the development of more efficient and effective removal techniques [11].

3 Contribution

3.1 Optimized Methodology

Most current methodologies and mine closure plans use chemical methods to manage tailings. The oxidation processes used under these methods to degrade CN from tailings, however, are expensive and could cause environmental problems. Mining companies spend large amounts of money on CN remediation and replacement. A CN oxidation by-product, however, could generate products with greater toxicity potential [12]. Other methodologies use physical methods such as encapsulating tailings with geomembranes

and other layers before burying them and reforesting the affected surface. Still, this method does not degrade the CN found in these tailings.

Hence, this study proposes using a biological method, i.e. microbial remediation to oxidize this compound from CN tailings. Research, therefore, was conducted using only pseudomonas fluorescens instead of a microbial consortium to test whether this bacterium could be adapted to the medium and oxidize CN.

3.2 Proposed Methodology

Collection and Identification of the Tailings Sample Components. A permit was initially requested from Minera Laytaruma SAC to sample two kilograms of tailings, as these contain CN and are highly toxic. The procedures in the regulations of the Soil Sampling Guide of the Ministry of the Environment (MINAM) and the CN Management Guide had to be followed. The following data were collected in the field: sample condition, location, date, time, sample quantity, weight, pH level, temperature, and pulp density. Table 1 shows the results. The samples were then brought to the Peruvian University of Applied Sciences, where the presence of other metals was tested to discard the presence of any other pollutant.

Development of Laboratory Tests. A chemical sample characterization was performed at the laboratory to determine the concentration of –CN and the pH level of the sample.

Then, the Fiola method was used to measure pulp density and calculate the specific gravity after previously estimating the percent solids. The pH level was measured with a pH meter and the amount of –CN was calculated using volumetric chemical analysis.

For the titration of CN (Volumetry), potassium iodide (KI), distilled water, silver nitrate (AgNO3), burette, a beaker, test tube, and filter paper were used.

Next, pulp water was filtered until obtaining 50 ml of wastewater. Afterward, 2.5 grams of silver nitrate and 5 grams of the potassium iodide indicator were diluted in distilled water. Subsequently, using the burette, the wastewater was poured into the beaker containing the silver nitrate solution and three drops of the KI indicator were added until the color changed from clear to yellow. This change in color was decisive in calculating the presence of CN. The pH level of this solution was also measured.

Rehydration, Massification and Injection of the Pseudomonas Fluorescens Bacteria. The pseudomonas fluorescens bacteria were purchased from a certified laboratory, Gen Lab del Perú S.A.C. The bacteria were then reactivated in the laboratory for subsequent injection into CN tailings samples.

The Pseudomona fluorescens was reactivated using four Petri dishes, a Trypticase Soy agar culture medium, an alcohol burner, surgical gloves, scrubs, dust mask, and a metal handle calibrated at 10 microliters (μl). The agar was then diluted and cooled before placing the plates with a 5 ml syringe. Simultaneously, the pseudomonas fluorescens was introduced to the moisturizing liquid, which is composed of sodium chloride, potassium chloride, magnesium chloride, monopotassium phosphate, disodium phosphate, sodium thioglycolate, and deionized water, all homogeneously mixed for plate insertion. In sample plate 1, 10 ml of culture medium and 10 μl of bacteria were introduced. Sample 2 contained 5 ml of culture medium and 1 ml of bacteria. In one of the remaining Petri

dishes, only 5 ml of culture medium was placed, and the last one had culture medium and 10 µl of CN tailings. These last two samples were used as pollutant control and to monitor the influence of other native microorganisms, respectively. All of these samples were placed in a kiln for 12 h at a constant temperature of 30 °C to accelerate bacteria growth. After this period, the bacteria were harvested and injected into the tailings samples.

Furthermore, a Gram-stain procedure was performed to validate whether we were using the correct bacterial strain.

Table 1. Sampling conditions

Sample	Tailings volume	Pseudomonas fluorescens volume	pH Level	Celsius Temperature (°C)	CN Concentration
1	90 ml	10 ml	10.5	30 °C	62.5 ppm
2	90 ml	20 ml	10.5	30 °C	62.5 ppm
3	90 ml	20 ml	10.5	22 °C	62.5 ppm
4	65 ml	25 ml	10.5	30 °C	62.5 ppm

The pseudomonas fluorescens bacteria were injected into four (4) samples with the same CN concentration level, the same pH level, and at two different temperatures. They all had different tailings and pseudomonas fluorescens volumes, as shown in Table 1.

4 Validation

When comparing the initial data against the final CN concentration data for the different tailings samples, we might observe a high percentage variation, as denoted in Table 2. This is significant for our study since the results help us validate our project hypothesis, especially since the results obtained during the processes improved as the number of hours increased.

Table 2. Comparison of results obtained

Initial CN Concentration (ppm)	Final CN Concentration (ppm)	Percentage Change (%)
62.5	6.25	**90.00**
62.5	3.75	**94.00**
62.5	8.75	**86.00**
62.5	3.75	**94.00**

Furthermore, we had comparable results for the pH level of the sample. That is, the initial alkaline level of 10.5 was reduced to a pH level of less than 9.5 (Table 3).

Table 3. pH level comparison

pH Level		
	Initial	Final
1	10.5	9.5
2	10.5	9.5
3	10.5	9.5

5 Discussion

By using pseudomonas fluorescens bacteria, we could reduce the amount of CN in the tailings samples. Bacteria, therefore, could be used as a new tailings management system. It improves the attachment of pollutants to the material to allow for better treatment based on the metabolic capacity of the bacteria, which oxidize CN and facilitate compound treatment. These findings were validated through statistical variance or dispersion of the sample data analyzed, which were taken from the tailings deposit at a small gold mine in the department of Ayacucho.

In this study, we only used pseudomonas fluorescens, which were not isolated from the contaminated medium. It, however, managed to remove 84% of the CN in 27 h under the same temperature conditions but at a higher pH level (10.5). Furthermore, no nutrients were added to the samples.

In the study conducted in Burkina Faso to treat areas contaminated by craft gold mining activity using different native bacterial species, the samples report a maximum initial concentration of 80 mg/l (ppm). This study could remove 95% of the–CN in 24 h at a temperature of 30 °C with an alkaline pH level (9.5). The results reported concentrations under 5.8 mg/l in a liquid medium without nutrients and 0.4 mg/l in a medium with nutrients. Here, the incorporation of nutrients was deemed as an important parameter for enhancing bacterial growth and, therefore, improving their efficiency levels [13].

6 Conclusions

This research study focused on using pseudomonas fluorescens bacteria to treat mining tailings with high CN content to reach low levels of –CN concentration and improve soil quality. Based on the results obtained, the pseudomonas fluorescens strain is effective for treating CN tailings since it can easily be adapted to this pollutant and reduce its concentration level by 89.2% in 72 h, at room temperature and alkaline pH conditions.

During the controlled temperature conditions in the first 24 h, the tests revealed that pseudomonas fluorescens are more efficient regarding CN degradation and bacterial massification/growth at 30 °C. In the same period at 22 °C, its elimination level, however, was 56%, i.e. it degraded 35.0 mg/l (ppm). Hence, we could conclude that temperature is critical for the development and implementation of the technique.

Another significant factor for the reduction of CN concentration is the volume of pseudomonas fluorescens injected into the tailings since these parameters are directly proportional. In other words, the larger the volume of bacteria introduced, the greater the

amounts of –CN that were removed. For this study, we used three samples at volumes of 10 ml, 20 ml, and 25 ml but with the same tailings ratio of 90 ml and the same initial concentration level of 62.5 mg/l. The final concentration results were 12.5 mg/l, 10 mg/l, and 8.75 mg/l, respectively.

References

1. Santini, T.C., Banning, N.C.: Hydrometallurgy alkaline tailings as novel soil forming substrates: reframing perspectives on mining and refining wastes. Hydrometallurgy **164**, 38–47 (2016)
2. Generados, M., El, E.N., Río, P.: Manejo, gestión, tratamiento y disposición final de relaves mineros generados en el proyecto río blanco. 12 (2018)
3. Sepúlveda, T.V., Velasco, J.A.: Tecnologías de remediación para suelos (2002)
4. Beltrán-rodríguez, L.N., Larrahondo, J.M., Cobos, D.: Emerging technologies for tailings disposal: opportunities for Colombian practice. Bol. Ciencias la Tierra **44**, 5–20 (2018)
5. Kumar, R., et al.: Remediation of cyanide-contaminated environments through microbes and plants: a review of current knowledge and future perspectives. Geosyst. Eng. **20**(1), 28–40 (2017)
6. Luque-Almagro, V.M., Moreno-Vivián, C., Roldán, M.D.: Biodegradation of cyanide wastes from mining and jewellery industries. Curr. Opin. Biotechnol. **38**, 9–13 (2016)
7. Ibrahim, Z., Tiong, B., Bahari, Z.M., Lee, N.S.I.S., Jaafar, J., Shahir, Z.: Cyanide degradation by pseudomonas pseudoalcaligenes strain W2 isolated from mining effluent. Sains Malaysiana **44**(2), 233–238 (2015)
8. Una, M., Nativa, C., Restrepo, O.J., Montoya, C.A.: Microbial degradation of cyanide from gold metallurgical plants utilizing P fluorecens. Dyna **73**, 45–51 (2006)
9. Anchiraico, A., Bazo, J., Aramburú, V., Raymundo, C.: Reuse method for deposits of polymetallic tailings in a state of abandonment through the application of mineral flotation. In: Smart Innovation, Systems and Technologies, vol. 140, pp. 141–149 (2018)
10. Botz, M.M., Mudder, T.I., Akcil, A.U.: Cyanide Treatment. Elsevier, Amsterdam (2016)
11. Luque-Almagro, V.M., Cabello, P., Sáez, L.P., Olaya-Abril, A., Moreno-Vivián, C., Roldán, M.D.: Exploring anaerobic environments for cyanide and cyano-derivatives microbial degradation. Appl. Microbiol. Biotechnol. **102**(3), 1067–1074 (2017)
12. Akcil, A.: Destruction of cyanide in gold mill effluents: Biological versus chemical treatments. Biotechnol. Adv. **21**(6), 501–511 (2003)
13. Razanamahandry, L.C., Andrianisa, H.A., Karoui, H., Kouakou, K.M., Yacouba, H.: Biodegradation of free cyanide by bacterial species isolated from cyanide-contaminated artisanal gold mining catchment area in Burkina Faso. Chemosphere **157**, 71–78 (2016)

Fundamental Criteria for Methodology of Blasting Engineering in Mining Grains to Reduce Mineral Dilution in Peruvian Polymetallic Underground Mining

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Abstract. This article analyzes the applicability of an appropriate design of blasting engineering for an underground mine to be used in a Peruvian grain context through the data collection and observation method using the Bieniawski rock mass geomechanical classification system, average vein power weighting, and operational dilution of the pits. The generation of solutions is under both the McCarthy approach formula and final results analysis of the dilution behavior obtained in relation to the initial ones. Moreover, the database provided by a mining company is analyzed with respect to the geological conditions for the rock mass classification of the roof box and floor box to determine the quality of the rock, ore grades, power of the vein, and the percentage of dilution. Then we proceed to determine the continuity and thickness of the vein in a given block and analyze the dilution based on the fundamental criteria of blasting engineering.

Keywords: Vein · Dilution · Cut and filler · McCarthy · Blasting engineering design

1 Introduction

At present, the mining industry is one of the economic pillars that drive the development of every nation. Peruvian mining is conducted mainly by underground exploitation owing to the presence of polymetallic and gold deposits. According to the Ministry of Energy and Mines, an estimated 38% of operations are underground operations. However, one of the greatest concerns that companies have are the uncertainties and risks that do not depend on the industry itself. From the beginning of the project and in operations already underway, among the most prominent uncertainties are the price of metals and mineral resources, which a company cannot control.

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However, the mine can handle operational problems such as the dilution of the mineral, which is the mixture of the economical ore and a sterile material. This undesired material not only affects the ore grade but also increases the tonnage mined for a given geological reserve, and therefore, increases the operating costs of the mining unit. Dilution is a problem that causes direct costs to increase since, disassembly affects blasting, hauling, transport and processing costs (crushing, grinding, etc.). On the other hand, also affect indirect costs because the diluted material can adversely affect metallurgical recovery and the degree of mineral concentration. This problem is caused by different factors such as poor operational design, lack of communication among work areas, and poor management of control techniques. Currently, the techniques used to control dilution include blasting controls, empirical controls, grade control, and ore control. Therefore, we will use a proper blasting engineering design as it guarantees a dilution reduction in underground veins by analyzing the planned and unplanned dilution. The former is defined as the tonnage of rock planned to be fractured over the tonnage of ore, whereas the latter is defined as fractured tonnage over the tonnage that was scheduled to be broken, which account for all the removed clearance and are actions not estimated by the mine planning area. This research describes a method developed to control the dilution of the ore and improve the operation and consequently the production.

2 State of the Art

Ore dilution is a common problem faced by mining companies in the Peruvian mines and worldwide.

The mixture of sterile material with economic ore, where its law is below the cutting law, which minimizes its value and, therefore, affects operating costs and production [1]. In addition, dilution is a mining efficiency indicator, since the greater the efficiency, the lesser the dilution and consequently, lower the production costs. The production costs are primarily quantified by the amount of over-excavation of the walls of the pit. On the other hand, dilution is a parameter that is considered closely related to the profitability of the project; therefore, the value of the mineral can be associated and compared with the operating costs within a mine [2].

One of the key factors that causes dilution is the separation of material deficiency during the mining operation process, taking into account the physical processes and operational and geometric mining configurations with the available equipment [3], among other factors.

To appropriately control the reduction of the dilution in veins, the analysis of two types of dilution is considered equally important: planned and unplanned dilution. A planned dilution is defined as the tonnage of rock planned to be fractured over the tonnage of ore, which will depend on the geometry of the vein, its thickness, the direction of the deposit, and the local soil conditions [4, 5]. An unplanned dilution is the fractured tonnage over the tonnage that was scheduled to be broken; it consists of the waste extracted because of excessive clearing that results from poor drilling or blasting, or it may also refer to the material that contaminates the economical ore and that comes from sources not taken into account during mining planning [6].

In addition, to be able to reduce the dilution, the evaluation of the mineral with economical value is sought for controlling and auditing the movement of the economical mineral and sterile material that is extracted from inside the mine; additionally, markings, handling, measurement, accumulation, distribution, and incorporation in the concentrating plant are realized [7].

3 Collaborations

A correctly planned dilution makes the operational work more effective because scheduling the tonnage of rock to be broken over the tonnage of ore is an important factor in preventing the dilution from increasing (Fig. 1).

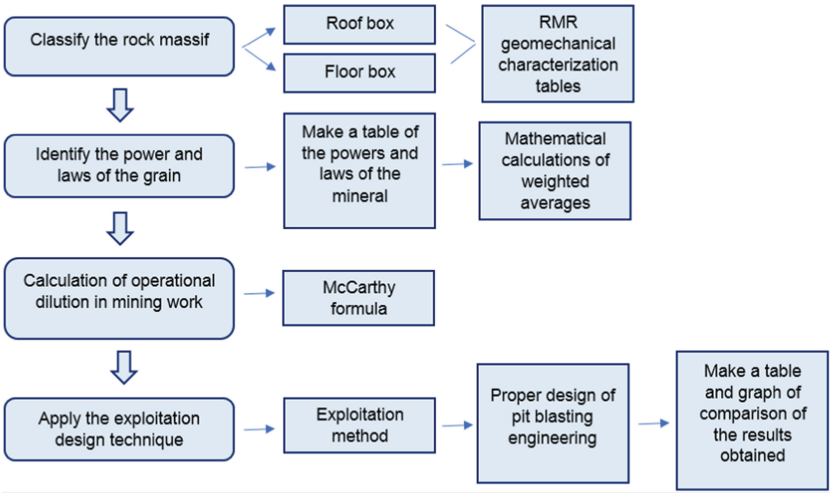

Fig. 1. Dilution analysis model

The correct design of the blasting engineering helps us to visualize the drilling mesh with the following established parameters: the theoretical and practical burden, loading per blast, efficiency, load per production hole, load per roof hole, broken volume, broken tonnage, advance factor, power factor, and load factor. In conclusion, all this results in the fragmentation obtained in order to have a control of the boxes in the gallery to avoid a more dilution percentage than planned.

Dilution is an indicator of mining efficiency, since the greater the efficiency, the lesser the dilution and therefore, the lower the production costs; this is quantified primarily by the amount of over-excavation of the pit walls.

Controlling the dilution is a fundamental indicator for all mining operations because it will provide better control over the pit boxes, avoiding overfilling. Furthermore, reducing the percentage of dilution contributes to ore loss management since less diluted ore will be sent to the plant to satisfy our internal customer and consequently, the expectations of the external customer will be met.

Minimizing operating costs is an indicator where it shows us that sending a ton of sterile to the plant is more expensive than sending a ton of ore, so with the proper design of blasting engineering, materials should be used correspondingly and likewise, dilution is optimized, avoiding over-breaking and contamination of the mineral.

Minimize the accident rate is an indicator that shows us that work is optimized since less cargo is transported and thus increases the safety for the worker because, the boxes and the gables are less altered.

The indicator of increasing productivity improves the productivity of the mining company because, at a lower percentage of dilution, the ore grade will rise when the proper design of the blasting engineering is established, where the operation will become more effective.

4 Validation

4.1 Case Study

In this research, a polymetallic mining unit to the north was considered as a case study. The underground mining company is engaged in the exploitation of copper, lead, silver, and zinc (polymetallic) minerals. The mining unit is located in the western mountain range of the Peruvian Central Andes.

4.2 Initial Diagnosis

The mining company has a database in which information was collected on the geomechanics of a mineralized horizon that has an average RMR 89 (Rock Mass Rating) of 68, type II, being a good rock, average power of the vein of 1.35 m and graded silver vein (Ag) 4.20 oz/tm, copper (Cu) 0.74%, lead (Pb) 4.92%, and zinc (Zn) 6.71%.

5 Results

A dilution analysis was conducted in block 05-S with McCarthy's formula.

Vein volume

$$V = 1.35\,m \times 1.80\,m \times 40\,m$$
$$V = 97.2\,m^3$$

Tonnage

$$T = 97.2\,m^3 \times 3\frac{TM}{m^3}$$
$$T = 291.6TMS$$

Clearance volume

$$V = 40\,m \times 1.80\,m \times 0.20\,m$$
$$V = 14.4\,m^3$$

Tonnage

$$T = 14.4\,m^3 \times 2.7\frac{TM}{m^3}$$
$$T = 38.88\,m^3$$

Dilution factor

$$Dil = \frac{38.88\,m^3}{291.6\,m^3} = 0.13$$

Dilution %

$$\%\,Dilución = \frac{0.13}{(1+0.13)} \times 100 = 11.50\%$$

The dilution is optimal and viable for the execution; therefore, the proper design of the blasting engineering was conducted (Fig. 2).

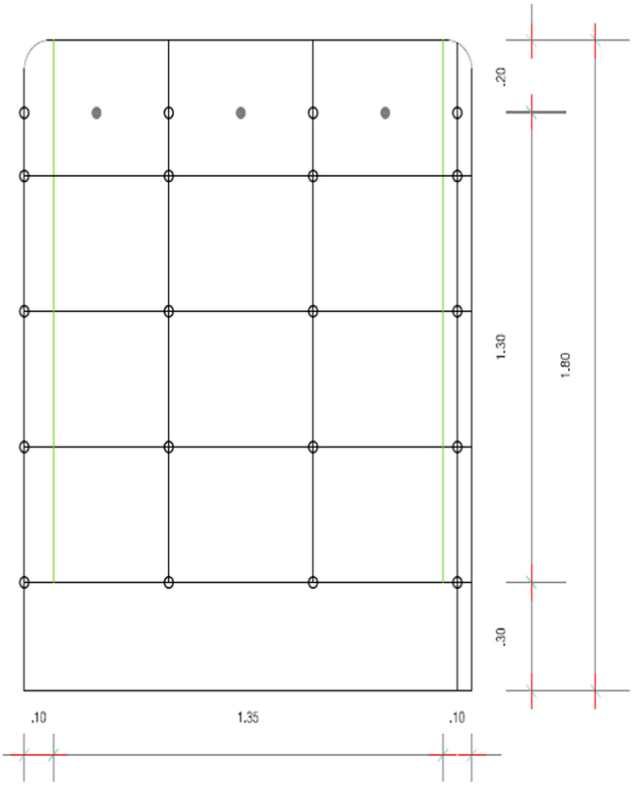

Fig. 2. Drilling mesh design

6 Conclusions

This research concludes that by analyzing the dilution using the McCarthy formula and applying the fundamental criteria of blasting engineering, our proposal is viable because it has a positive impact in minimizing the dilution when performing mathematical calculations with the formula and proper drilling mesh design. The dilution analysis has developed an evidence base that makes it is an effective tool for mining companies. In addition, our proposal can be applied in other mining units that use the ascending cut and fill up (breasting) method of exploitation.

When analyzing the dilution, it is concluded that with the help of RMR 89 (Rock Mass Rating) we could see the geomechanical conditions of our rock mass and thus classify the rock in order to see the hardness of our body, which evidenced that the mineralized horizon had an RMR of 68, being a good type II rock.

Information on the grade and average vein power was obtained, giving the following results: vein power of 1.35 m, Ag grade of 4.20 oz/tm, Cu grade of 0.74%, Pb grade of 4.92%, and Zn grade of 6.71%. This data will be useful for our third specific objective. A dilution of 11.50% was obtained using the McCarthy technique, which corresponds well with the acceptable value of the parameter of the dilution of approximately 10% according to studies in terms of evaluation of the dilution with characteristics of the cut and fill mining method.

Finally, a planned dilution must be carried out since it is the tons of rock that is planned to be broken, above the tons of ore. Therefore, owing to operational data, a clearance width of 0.20 m was added to our average vein power, resulting in a mining width of 1.55 m. Subsequently, for the drilling mesh design, a load of 0.50 m was given, leaving a free face at the bottom of 0.30 m and at the top of the roof 0.20 m to prevent damage to the boxes. With all these parameters, 20 drills and 3 relief drills were used.

Accordingly, with the mesh design and planned dilution of 11.50%, the study proved effective when applied to a mining company. It will help in avoiding a high dilution percentage, which is an indicator of mining efficiency, and realize higher efficiency, lower dilution, and consequently lower production costs that are quantified primarily by the amount of over-excavation of the walls of the pit.

References

1. Calderon-arteaga, C.H., Barrios, J., Almond, M., Ruiz, R., Gering, S.: Ore control technological innovations at Goldcorp's Peñasquito Mine. Min. Eng. **70**(7), 16–25 (2018)
2. Bannister, K.: Estimation of open cut mining recovery and mining dilution. pp. 1–6
3. Câmara, T.R., Peroni, R.D.L.: Quantifying dilution caused by execution efficiency. REM – Int. Eng. J. **69**(4), 487–490 (2016). https://doi.org/10.1590/0370-44672014690006
4. Grandez, S.: Control de dilución en vetas angostas: caso mina San Rafael. Universidad Nacional de Ingeniería (2016). https://alicia.concytec.gob.pe/vufind/Record/UUNI_9b54d9a1429a1a4a03d80ca4d52598cd
5. Salgado-Medina, L., Núñez-Ramírez, D., Pehovaz-Alvarez, H., Raymundo, C., Moguerza, J.M.: Model for dilution control applying empirical methods in narrow vein mine deposits in Peru. Adv. Intell. Syst. Comput. **971**, 435–445 (2019)

6. Salmenmaki, P.: Reducing dilution with narrow-vein mining: a plan that considers drive size: EBSCOhost, **219**(9), 42–45 (2018). http://web.a.ebscohost.com/ehost/detail/detail?vid=5&sid=ff5339d1-10c9-45a0-b03b-836f00e36955%40sessionmgr4009&bdata=Jmxhbmc9ZXM%3D#AN=131826922&db=asn
7. Portocarrero Oviedo, H.: Procedimiento de ore control para vetas unidad opera-tiva Inmaculada Oyolo – Ayacucho Informe por Servicios Profesionales. Universidad Nacio-nal de San Agustín, Universidad Nacional de San Agustín de Arequipa (2017). http://repositorio.unsa.edu.pe/handle/UNSA/2993

Method for the Interpretation of RMR Variability Using Gaussian Simulation to Reduce the Uncertainty in Estimations of Geomechanical Models of Underground Mines

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Abstract. The application of conventional techniques, such as kriging, to model rock mass is limited because rock mass spatial variability and heterogeneity are not considered in such techniques. In this context, as an alternative solution, the application of the Gaussian simulation technique to simulate rock mass spatial heterogeneity based on the rock mass rating (RMR) classification is proposed. This research proposes a methodology that includes a variographic analysis of the RMR in different directions to determine its anisotropic behavior. In the case study of an underground deposit in Peru, the geomechanical record data compiled in the field were used. A total of 10 simulations were conducted, with approximately 6 million values for each simulation. These were calculated, verified, and an absolute mean error of only 3.82% was estimated. It is acceptable when compared with the value of 22.15% obtained with kriging.

Keywords: Gaussian simulation · Uncertainty analysis · Geostatistics · Geomechanical uncertainty · RMR

1 Introduction

Underground mining is an activity focused on the exploitation of resources that are below the Earth's surface. It is mainly conducted when open-pit mineral extraction is not feasible because of environmental, social, or economic factors. Consequently, the construction of different types of underground works has been increasing in recent years. To ensure the stability and safety of such excavations, studies of rock mass must be undertaken based on geomechanical variables such as the Q-system [1] for rock

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mass rating (RMR) [2, 3] or rock quality designation (RQD) [4], among others. Their purpose is to estimate the expected characteristics and underground behavior of rock mass. Currently, a suitable general understanding of rock mass geomechanical properties is important for a mining project's design, planning, production schedule, and economic assessment. This is required specifically if the plan is to design an underground mine, since there is a tendency to improve yields and the safety of the underground tasks. Therefore, the technique applied in the estimation of geomechanical variables will impact the identification of significant aspects such as fragmentation, stability for work, and the design of infrastructures to a great extent [5, 6]. Nevertheless, current techniques applied to determine these variables are inaccurate in several ways because they do not take into account intrinsic spatial variability and the heterogeneities of the rock mass. Hence, diverse estimation techniques that are consistent with the nature of rock mass have been proposed. Among these, in the past decade, the Gaussian simulation has stood out owing to its effectiveness that has been proved in different fields. In 2018, in an African copper deposit, an uncertainty quantification study was conducted to estimate the grade and tonnage using Gaussian simulation. An estimation error of only 4.33% in grade and 3%–5% in tonnage was obtained [7, 8].

To reduce the uncertainty in the estimation of geomechanical variables for generating a geomechanical model with greater accuracy and reliability for further design of the mine, this study proposes an interpretation method of RMR variability using Gaussian simulation applied to a specific underground mine. This is because there are still deficiencies in the scope and content of the rock mass studies conducted presently because the underground works continue to present stability problems caused by the fact that in most cases, they have been affected by different geological structures or by the same method of exploitation. Therefore, it is usually reinforced after losses of stability have already occurred, or simply the entire excavation is supported preventively, thus directly influencing the expenditure of resources [5, 9].

2 State of the Art

In two studies, the first one at a Chilean copper deposit and the second one at a large Indian deposit, a comparison of two approaches to the Gaussian simulation based on RMR values was proposed to determine the quality of the rock mass. The first approach considered this geomechanical classification as a continuous quantitative variable (0–100) with a direct simulation. The second one applied a variation of the technique from a truncation of underlying parameters (the truncated Gaussian simulation) [10, 11]. It considered each parameter underlying the RMR as a discrete variable and simulated it independently to subsequently combine each of these results and obtain a final RMR value [12, 13].

Based on these methodologies, different authors have demonstrated that additional information is obtained on the properties of the rock mass and that the degree of uncertainty in the estimation of values is lesser, since the results showed an error of just 2.93% [13, 14], which is completely acceptable on a scale of 0–100. For the Gaussian simulation to be applicable, a condition of 10 km^2 was stated in a geostatistical study of an iron ore deposit in central Iran. In this study, it was shown that the use of less than 50 data

samples generally does not satisfy the reproduction of statistics of the primary model of experimental variograms (responsible for quantifying the spatial correlation structure of the field), and in some cases, over 200 data samples are required to precisely replicate the statistics of the model. Similarly, several authors recommend the finite difference analysis technique to supplement the application of this methodology. This technique focuses on the selection of a small number of simulations that can be considered a representative sample of all implementations of the study [11, 15, 16]. The aim is to reduce computational costs produced by the quantity of the study data. To complement this technique, several methodologies have been proposed in the last few decades to test and improve simulation accuracy. Additionally, attempts have been made to improve the assessment of uncertainty and risk in the simulation result by introducing a new approach to fitting the geostatistical model's parameters.

For this purpose, the cross-validation method was used, and a conditional function was formulated to improve the quality of the geostatistical models, where the error rates in the estimation of geomechanical parameters ranged from 4% to 7% [17, 18].

3 Collaborations

3.1 Proposed Method

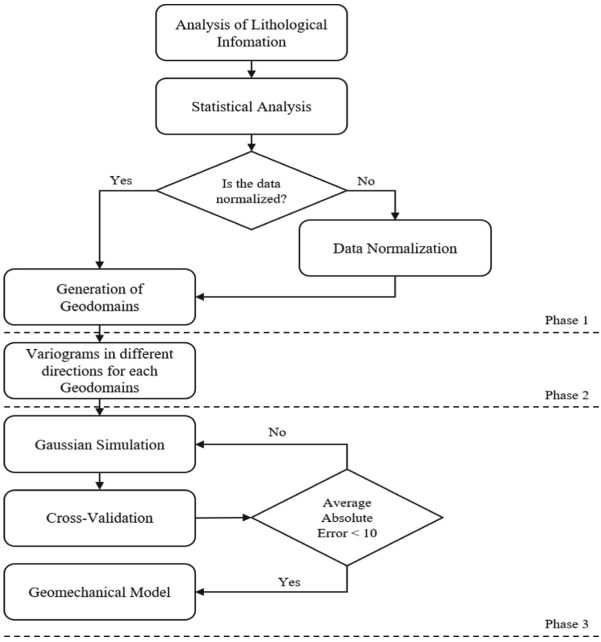

Fig. 1. Proposed methodology

The methodology proposed herein considers variographic analysis with four directions to determine the anisotropic behavior of studied variables (RMR). Their spatial

distribution in cells with smaller dimensions was analyzed to ensure a more accurate estimation (Fig. 1).

Furthermore, the acceptance criterion for each simulation is that the percentage of error should be less than 10. Each simulation must fulfill this condition to be considered in the generation of the geomechanical model.

3.2 Method Components

Phase 1: Geostatistical Analysis. The resulting information was analyzed to determine the current conditions of the rock mass. This is an important objective for subsequent stages of the study. A detailed report of the conditions of the rock mass was prepared. To do this, the data must be previously verified and validated by using normality tests with histograms.

After this, a statistical and geostatistical analysis was undertaken with SPSS software to transform data of geomechanical classification systems by applying the Gauss algorithm. It produced principal component analysis (PCA) diagrams, Pearson correlation tables, numerical statistics records, and graphics (such as histograms, box diagrams, and probability diagrams). After this, the holes were analyzed by using the Datamine software to establish geomechanical domains, variograms, and criteria of estimation to create an estimated block model by using the kriging technique.

Phase 2: Gaussian Simulation. Values of classification systems of the rock mass were simulated in this phase by running the Datamine software. The variograms were imported after they were generated to work with the same analytical criterion of the rock mass anisotropy. Ten simulations were conducted for the RMR to obtain a simulation memory to be analyzed by using a numerical statistic.

Phase 3: Geomechanical Models. The validity of the simulated data was verified by cross-validation. To achieve this, the original data were randomly divided into two subsets. After this, one subset (a working subset of 85%) was taken as the main database for the calculation of RMR values. The second subset (a test subset with 15% of data) was used to validate the results of the simulation process and the maximum acceptable error for each simulation was 10%. If this condition is not fulfilled, the execution of additional simulations is required. The error was estimated by applying the absolute average error (EMA is the Spanish acronym) method.

The last step was to apply the Datamine software to generate the geomechanical model. This is the fourth objective. Simulations generated previously were supplemented with geological and structural models to create a model that included all rock mass features.

3.3 Indicators

Variograms. The analysis of variograms entails the identification of the spatial correlation of data.

$$y(h) = \frac{1}{2}\Sigma\left([Z(x+h) - Z(x)]^2\right) \tag{1}$$

This process depends on the level of similarity among the variographic structures for diverse directions. When structures are similar, the variable under test has an isotropic behavior. Otherwise, its behavior is considered anisotropic.

Average Standard Deviation. This shows the degree of variability of the analyzed simulations.

$$\sigma_{\text{promedio}} = \frac{\sqrt{\frac{1}{N}\sum_{i=1}^{N}(x_i - \mu)^2}}{n_{\text{sim}}} \tag{2}$$

When the average standard deviation is greater, this means that the variability of estimated values is also greater. Therefore, the probability of errors is higher.

Average Absolute Error (EMA). The error size is measured according to percentages, and the error is weighted depending on the number of estimated values.

$$\text{EMA} = \frac{\sum_{t=1}^{n}\left|\frac{Y_t - Y'_t}{Yt}\right| * 100}{n} \tag{3}$$

It is used to calculate the percentage error of forecast weighted values based on the number of estimated values. The estimate will be less reliable if the error is greater.

4 Validation

4.1 Description of the Scenario

The area of diamond drilling is located in the district of Marcapomacocha, a province of Yauli, in the Junín region, around 4600 masl. The place is called Huancash, and the Puca Rumi hill is located around 3.75 miles from Sangrar, a village, and 14.4 miles from Marcapomacocha.

4.2 Initial Diagnosis

The geomechanical model used for the current mine planning has been developed based on the kriging technique. The identification of geodomains of critical quality has not been possible with these tools. Additionally, in the anisotropic analysis implemented by this technique, the 45° and 135° directions were not considered in this methodology. Such additional data would reveal the anisotropic behavior of the RMR.

Indicators of geodomain 2 were included, as it is the most frequent one in the deposit.

Variograms. The initial variograms were analyzed only for the 0° and 90° directions, which determined an isotropic behavior of the rock mass.

Average Standard Deviation. By using kriging, the average standard deviation of values was calculated for geodomain 2, and the result of 2.50 differs from its actual average standard deviation of 6.724.

Average Absolute Error. This error of the geomechanical model calculated using kriging is 22.15%.

4.3 Application in Scenario

Geometric Model. The results are based on the research methodology. The results of numerical and graphic statistical analyses of three geodomains selected based on a compositing process conducted every 10 m are shown below. Three different colors are shown in geometric solids. Each one identifies a dominant RMR range for each geodomain included in the legend.

Variograms. The research methodology recommends the analysis of variograms in four directions for the rock mass. The aim of the analysis is to determine if the RMR parameter has an anisotropic behavior. After this, only the variograms generated for geodomain 2 are shown. RMR values from 40 to 60 are the predominant ones. Only these results are shown because this geodomain predominates at the site.

After performing a variographic analysis of the 0°, 45°, 90°, and 135° directions, it was determined that the behavior of the RMR is anisotropic, because no structural matches were detected in variograms of the diverse directions. Moreover, the RMR variance in this geodomain is 116.79, which contributes to explaining this behavior.

Geomechanical Model. After selecting the suitable simulation and generating its block model, the geomechanical model of Fig. 2 was produced. It graphically shows a comprehensive distribution of the RMR of the total rock mass under study. The estimation error was calculated by applying a cross-validation and it was estimated using the absolute average error (EMA is the Spanish acronym). The result is an error of 3.832% for rocks of type III regular quality. This proves that values were estimated with a lesser degree of uncertainty compared with the values that were initially calculated with kriging (with an error of 22.152%).

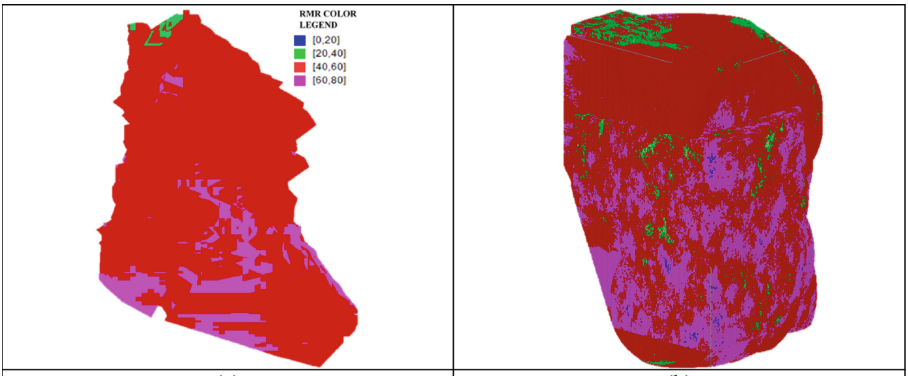

Fig. 2. a) Geomechanical model kriging; b) Geomechanical model Gaussian simulation

5 Conclusions

Simulated RMR values showed a close relationship with actual RMR values (an error of 3.83%). This is because the methodology proposes four directions for the variographic analysis to verify the anisotropic behavior of the rock mass.

By contrast, values obtained with kriging (an error of 23.15%) did not represent the actual features of the rock mass, especially for type III regular quality rock, the most frequent one in the deposit. These results did not facilitate the identification of critical areas (RMR < 20) of the deposit.

This research presents the potential benefit of the use of Gaussian simulation for the estimation of RMR values for the geomechanical model, which is used for the design of the mining plan, design of underground excavations, and their support.

References

1. Barton, N., Lien, R., Lunde, J.: Engineering classification of rock masses for the design of tunnel support. Rock Mech. Felsmechanik Mécanique des Roches **6**(4), 189–236 (1974)
2. Bieniawski, Z.T.: Engineering classification of jointed rock masses. Civ. Eng. S. Afr. **15**(12), 335–343 (1973)
3. Bieniawski: Exploration for rock engineering. 97–106 (1976)
4. Deere, D.U.: The rock quality designation (RQD) index in practice. 91–101 (1988)
5. Cartaya, M.: Caracterizacion geomecánica de macizos rocosos en obras subterráneas de la región oriental del país (2006)
6. Ferrari, F., Apuani, T., Giani, G.P.: Rock mass rating spatial estimation by geostatistical analysis. Int. J. Rock Mech. Min. Sci. **70**, 162–176 (2014)
7. Paithankar, A., Chatterjee, S.: Grade and tonnage uncertainty analysis of an african copper deposit using multiple-point geostatistics and sequential gaussian simulation. Nat. Resour. Res. **27**(4), 419–436 (2018)
8. Kova, Z., Cvetkovi, M., Parlov, J.: Gaussian simulation of nitrate concentration distribution in the Zagreb aquifer. J. Maps **13**(2), 727–732 (2017)
9. Perez, M.S., et al.: Estudio comparativo entre sistemas de clasificación geomecánica en un depósito tipo Pórfido. Boletín Ciencias la Tierra **43**, 34–44 (2018)
10. Eivazy, H., Esmaieli, K., Jean, R.: Modelling geomechanical heterogeneity of rock masses using direct and indirect geostatistical conditional simulation methods. Rock Mech. Rock Eng. **50**(12), 93–103 (2017)
11. Pinheiro, M., Emery, X., Miranda, T., Vallejos, J.: Truncated gaussian simulation to map the spatial heterogeneity of rock mass rating. Rock Mech. Rock Eng. **49**(8), 3371–3376 (2016)
12. Kang, N., Yongzhi, W., Hui, Z., Sheng, Y.: Construction and application of 3D geological models for attribute-oriented. J. Appl. Sci. Eng. **18**(4), 315–322 (2015)
13. Vatcher, J., McKinnon, S.D., Sjöberg, J.: Developing 3-D mine-scale geomechanical models in complex geological environments, as applied to the Kiirunavaara Mine. Eng. Geol. **203**, 140–150 (2016)
14. Pinheiro, M., Vallejos, J., Miranda, T., Emery, X.: Geostatistical simulation to map the spatial heterogeneity of geomechanical parameters: a case study with rock mass rating. Eng. Geol. **205**, 93–103 (2016)
15. Safikhani, M., Asghari, O., Emery, X.: Assessing the accuracy of sequential gaussian simulation through statistical testing. Stoch. Environ. Res. Risk Assess. **31**(2), 523–533 (2017)

16. Ozturk, H., Erkayaoglu, M.: Interpretation of variability of rock mass rating by geostatistical analysis: a case study in Western Turkey. Arab. J. Geosci. **11**(13), 344 (2018)
17. Novak Zelenika, K., Vidaček, R., Ilijaš, T., Pavić, P.: Application of the deterministical and stochastical geostatistical methods in petrophysical modeling, case study Upper Pannonian reservoir, Sava depression. Geol. Croat. **70**(2), 105–114 (2017)
18. Mayer, J.M., Stead, D.: A comparison of traditional, step-path, and geostatistical techniques in the stability analysis of a large open pit. Rock Mech. Rock Eng. **50**(4), 927–949 (2017)

SCAT Model Based on Bayesian Networks for Lost-Time Accident Prevention and Rate Reduction in Peruvian Mining Operations

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Abstract. Several factors affect the activities of the mining industry. For example, accident rates are critical because they affect company ratings in the stock market (Standard & Poors). Considering that the corporate image is directly related to its stakeholders, this study conducts an accident analysis using quantitative and qualitative methods. In this way, the contingency rate is controlled, mitigated, and prevented while serving the needs) of the stakeholders. The Bayesian network method contributes to decision-making through a set of variables and the dependency relationships between them, establishing an earlier probability of unknown variables. Bayesian models have different applications, such as diagnosis, classification, and decision, and establish relationships among variables and cause–effect links. This study uses Bayesian inference to identify the various patterns that influence operator accident rates at a contractor mining company, and therefore, study and assess the possible differences in its future operations.

Keywords: Bayesian net-work · Accident · Prevention · Mining · Peruvian

1 Introduction

Safety is an important issue in many industries, especially mining industry. In fact, this industry has been deemed as the most dangerous industry worldwide due to the various hazards and risks it generates [1]. Since high-risk industries, such as construction, energy, and mining, play a significant role in a country's development, several trained personnel are often required. These human resources are not necessarily staffed in-house, but for the company's own reasons -such as lack of personnel or economic factors- greater efficiency is achieved when outsourcing. Therefore, mining companies often outsource their work to third parties (hereinafter "contractors"). The use of contractors not only yields better results and economic benefits in operations but also increases their market share. This

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means that multiple contractors from multiple companies can work in the same place at the same time [2]. The companies are vulnerable to the economic and social conflicts originating from the accidents caused by the extraction of natural resources (such as mineral ore, in this case) [3].

There are two types of accidents: lost-time accidents and fatal accidents (we will focus only on lost-time data since fatal events cannot be assessed as they do not provide enough feedback to prevent them within the company's safety culture). The International Standardization Organization (ISO) has issued meaningful standards regarding a company's life cycle and the market requirements, which can be used to make the organizational culture more competitive.

For the purposes of this paper, the systematic cause analysis technique (SCAT) can be used to supplement the Bayesian network (BN) for reducing accident rates, which are associated with risk prevention. This study is quasi-experimental, not probabilistic, and is conducted at a contractor mining company. This technique focuses on the identification and control of the different causes of accidents, especially since the average accident rate has been increasing. As mentioned above, this study seeks to control and/or mitigate time-loss accidents through the SCAT method, as this computer tool is commonly used in these industries. Its purpose is to avoid subjectivity when investigating work-related accidents, thus generating a report capable of establishing the necessary corrective and preventive measures and improving the investigation process in terms of time and cost (Table 1).

Table 1. Abbreviations and acronyms.

Abbreviation	Definition
Osinergmin	Peruvian Supervisor Agency for Investments in Energy and Mining
Sunafil	Peruvian National Labor Superintendence
E.O.	Executive Order
SRT	Single Revised Text
BATNA	Best alternative to a Negotiated agreement
BN	Bayesian Networks
IDs	Influence Diagramas
SCAT	Systematic Cause Analysis Technique

2 State of the Art

2.1 Model for the Prevention of Lost-Time Accidents in Mining Operations

In the contract mining industry, as validated by several authors, [1, 4, 5], the main causes of accidents are leadership and decision-making. In fact, decision-making is vital for our results since the proposed BN model is probabilistic in nature. Hence, by

combining random variables, uncertainty can be reduced and mitigated in relation to the occurrence of these unwanted events. The ability to learn is considered a central feature of "intelligent systems" [6, 7], so effort and dedication have been invested in the research and development of this field.

2.2 BNs Applied to Accident Investigation

Learning can be defined as "any process through which a system improves its efficiency." Any system with knowledge mastery is important for the development of inductive learning generated after obtaining the variables from the phenomenon and correlating system data to predict the behavior of unknown variables based on the behavior of previously known variables. According to the above authors, the existing models within the context of uncertainty and their correlation to risk assessment indicate that the probability of a phenomenon attributable to unknown causes is high according to the statistics represented in the linear regression data.

3 Contribution

3.1 Proposed Model

The company's current accident investigation system is consistent with the application of the DNV SCAT table, as part of the implementation of the SCAT method. Nevertheless, as it is a subjective system and based on templates, new work factors cannot be selected for development throughout the company's life cycle, making this methodology alien to other existing investigation strategies. As it is a qualitative model, percentages can neither be considered nor can we determine whether an accident type is recurrent. Consequently, there is no analytical variable that supports decision-making. For this reason, a complementary system, such as BNs, is required. As a new artificial intelligence (AI) system, this system can be expanded to any area where variables are ambiguous or non-existent. Still, a cause analysis methodology must be systematically applied to encourage an evolution in preventive measures. Likewise, regarding data collection, the information must be accurate and measurable to avoid any type of speculation.

3.2 Model Components

As part of improving the company's SCAT system, the use of software increases the likelihood of efficiency, since the results are numerically and systemically monitored, resulting in a reduction in accident rates. In terms of modified artefacts, the first instance seems to be the DNV SCAT table, which is applied as a base model in the company. Given the multiple-option procedure, this table determines the high probability that this event and/or isolated phenomenon does not occur again. In this way, the history data, which turn yearly statistics into atypical, are generated from the lack of follow-up and control after the due process, influenced by the non-observance and lack of sensitivity to the incidents. The non-observance or lack of interest from the contractor's staff, as well as that from their employers, leads to risky behaviors. Therefore, most of the cases represent violations to Peruvian law with possible imprisonment results.

This method enhancement aims at gradually decreasing the accident rates, to create a higher competitive advantage in the sector. Recently, this tendency of obtaining data in a subjective and probabilistic way has caused accident rates to be determined by mining companies, to reach an ideal, so that organizational changes can be generated and a greater efficiency in mining operations can be achieved.

3.3 Proposed Method

As previously demonstrated throughout this paper, the proposed method is based on the data provided by the company itself. With the database, the basic and immediate causes are analyzed, so that probability tables can be created. Likewise, both quantitative and qualitative data are sorted for building BN structures within the program. On an ongoing basis, the internal or external probabilities obtained from the corresponding investigations are allocated to assess the possible action items. If the investigation into basic accident causes is positive, a follow-up and control will be conducted based on the recommendations proposed for their corresponding samples. However, if inconsistencies are found in these causes, a database feedback will be issued to limit the causes that generate the data curvature. Figure 1 denotes the general process flowchart followed during the investigation.

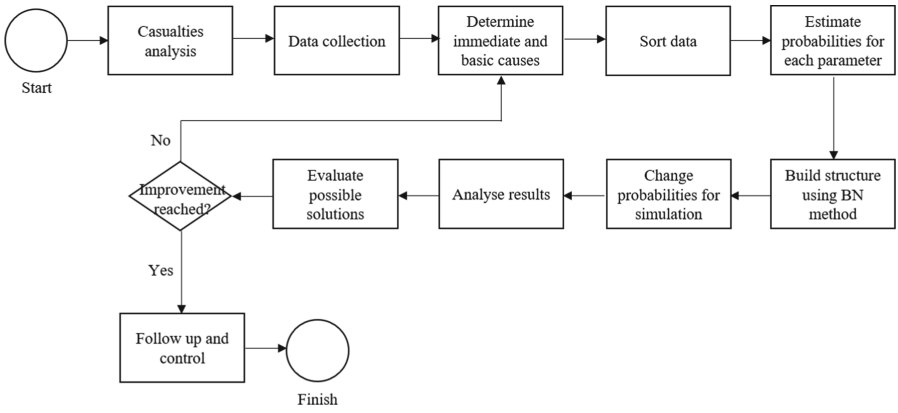

Fig. 1. Investigation process map

3.4 Indicators

As success indicators, the classification of the basic accident causes and conditions leads to the generation of a main classification chart, where the options that cause a higher accident rate are evidenced. Next, these percentages are analyzed through the Elvira software by entering these data values to the BN. These same percentages initially obtained are used as the base elements. Hence, these data are used to determine the third indicator, which assess new parameters with the most representative basic and

immediate causes, thus causing a variation in the percentages obtained. This variation confirms a data transmission error percentage when performing the investigation. As previously discussed, accident causes are first communicated orally. Then, accidents are documented based on the statements from everyone involved. The last indicator is a table comparing these results against the initial data, so that new action items can be performed to validate the decrease in these numerical parameters, which translates into a monthly control based on observations, frequency reports, and a follow-up process aligned with institutional processes. This way, there is no need for further effort, but instead included in accident assessment, to monitor short- and long-term processes. The following chart denotes the task system executed during the investigation process.

4 Validation

The company under study is a diamond and geotechnical drilling contractor. Based on the total number of projects opened and closed for business reasons, the average number of man-hours worked is medium-high in comparison to their competitors. This company forms part of a large mining group, where each contracting company has different specializations.

After reviewing the contractor's incidents reported in recent years, we can classify their accidents based on their causes, in order to determine their occurrence frequency. For these purposes, the SCAT table is used to identify the causes according to the criteria observed in the accident statements and reports. However, since some reports only contain basic accident information, and in some cases, there are no physical reports, not all research elements and observations are submitted for analysis.

Table 2. Accident type frequencies according to corresponding accident total.

Type of accident	Immediate cause	Basic cause	Frequency	Location	Severity	Frequency (%)
Amputation	Substandard acts and conditions	Personal and work related factors	1	Operations	High	2%
Entrapment			1	Operations	Medium	2%
Physical wear			2	Operations	Medium	3%
Collision			1	Operations	Medium	2%
Contusion			40	Operations	Low	61%
Cut			4	Operations/Maintenance	Medium	6%
Fracture			12	Operations	Medium	18%
Wound			1	Operations	Medium	2%
Irritation			1	Irritation	Low	2%
Mutilation			2	Operations	High	3%
Burn			1	Operations	Low	2%
Total			**66**			**100%**

Furthermore, the basic and immediate causes are sorted by their percentages in the Elvira software. This also contributes to our second indicator since the related causes and consequences have been recorded in BNs. With the percentages obtained by the Elvira program, besides the BN indicator, we can identify the most common type of accidents along with their basic and immediate causes (Table 2).

In these data, contusions and fracture accidents are the most frequent, which make their causes relevant. By changing the probabilities to prevent these two types of events from occurring, an individual simulation is performed, followed by a joint simulation. In this way, the most significant basic and immediate causes are identified both at a macro and a micro level. Hence, the basic and immediate causes with higher percentages of occurrence are identified (Tables 3 and 4).

Table 3. Most relevant basic cause probabilities obtained from the BN´s.

Basic cause	Current probability	Contusion simulation	Fracture simulation	Joint simulation
Inadequate materials	0.02	0.02	0.02	0.02
inadequate tools	0.03	0.03	0.03	0.03
insufficient supervisions	0.26	0.25	0.26	0.25
Inadequate maintenance	0.08	0.08	0.08	0.08
Lack of ability	0.29	0.28	0.29	0.28
Abuse and misuse	0.02	0.02	0.02	0.02
Poor Knowledge	0.33	0.33	0.33	0.33
Wear and tear	0.02	0.02	0.02	0.02
Inadequate design	0.09	0.09	0.09	0.09
Inadequate motivation	0.21	0.21	0.21	0.21
Work rules	0.02	0.02	0.02	0.02

Table 4. Immediate cause probabilities obtained from the ELVIRA simulation.

Immediate causes	Current probability	Contusion simulation	Fracture simulation	Joint simulation
Limited space	0.02	0.02	0.02	0.02
Lack of warning signs	0.05	**0.04**	0.05	**0.04**
environmental conditions	0.00	0.00	0.00	0.00
Operate equipment without authorization	0.01	**0.00**	0.01	**0.00**
Operate at wrong speed	0.01	0.01	0.01	0.01
Lift objects incorrectly	0.03	0.03	0.01	0.03
Improper use or disregard use of PPE	0.01	0.01	0.03	0.01
Disable safety devices	0.01	0.01	0.01	0.01
Inadequate light	0.00	0.00	0.01	0.00
Defective equipment	0.03	0.03	0.00	0.03
Failure to adequately secure	0.07	**0.06**	**0.06**	**0.06**
Inadequate usage of equipment	0.01	0.01	0.01	0.01
Inadequate protection equipment	0.00	0.00	0.00	0.00
Equipment maintenance	0.03	0.03	0.03	0.03
Inadequate posture	0.04	0.04	0.04	0.04
Poor order and cleanliness	0.04	**0.03**	0.04	**0.03**
Inadequate safety and protection	0.02	0.02	0.02	0.02

5 Final Results

The data required by the Elvira software for using the Bayes theorem, and the probabilities for each basic and immediate cause. For the former, the causes with the greatest possibility of occurrence are lack of knowledge (33%), lack of ability (29%), insufficient supervision (26%), and inadequate motivation (21%). Likewise, for the latter, the causes are failure to adequately secure (7%), lack of warning signs (5%), adopting an inadequate position (4%), and poor order and cleanliness (4%).

6 Conclusions

According to the results, the types of accidents that had the highest frequency from 2010 to 2019 are "contusion" (61%) and "fracture" (18%), so simulations were performed with a reduction in these two types of accidents.

The description of the events submitted by the company's reports was instrumental in identifying the basic and immediate causes of accidents. Likewise, all possible variables (causes) were taken into account, unlike the SCAT method used by the company, where only a standard list of accident causes, and types was used.

The use of "Elvira" software to form BNs was useful and practical, since it identified when one variable was already related to another. On the other hand, the probabilities for "contusion" and "fracture," which had several immediate causes, exhibited extensive data, thus making it more tedious or difficult to enter the data into the software.

Simulations to reduce the occurrence of "contusion" and "fracture" were used to identify the critical basic and immediate causes. The results revealed "insufficient supervision" and "lack of ability" as basic causes, and "lack of warning signs," "operate equipment without authorization," "failure to adequately secure," and "poor order and cleanliness" as immediate causes.

According to the results presented in the paragraph above and in this study, in general, the main issues for the company are "personal factors" as basic causes and "unsafe acts" as immediate causes.

Therefore, the BN technique has been proven more effective than the SCAT methodology, since BNs use all existing causes and work with quantitative and qualitative variables. On the other hand, the SCAT only uses a standard list of basic and immediate causes and accident types, and decisions are made based on experience and qualitative observations.

References

1. Smith, T.F., Waterman, M.S.: Identification of common molecular subsequences. J. Mol. Biol. **147**, 195–197 (1981)
2. Nima, K., Faisal, K., Paul, A.: Quantitative risk analysis of offshore drilling operations: a Bayesian approach. Saf. Sci. **57**, 108–117 (2013)
3. Haas, E., Yorio, P.: Exploring the state of health and safety management system performance measurement in mining organizations. Saf. Sci. **83**, 48–58 (2016)

4. Domínguez N., Rodríguez J., Jara J., et al.: Occupational health and safety maturity model to manage the surface mining operations. In: 2019 Proceedings 23rd World Multi-Conference on Systemics, Cybernetics and Informatics (WMSCI 2019), vol. 4, pp. 17–20 (2019)
5. Bird, F., Germain, G.: Liderazgo práctico en el control de pérdidas. Det Norske Veritas, Longville, Georgia (1990)
6. Pearl, J.: de Probabilistic Reasoning in Intelligent Systems: Networks of Plausible Inference, p. 552. Morgan Kaufmann Publishers Inc, San Francisco (1988)
7. Ramoni, M., Sebastiani, P.: Bayesian Methods in Intelligent Data Analysis, pp. 129–166. Springer, Heidelberg (1999)

Hydrabolt and Split Set Rock Bolt Selection Method Under the Bieniawski Rock Mass Rating for Improving Horizontal Access Support in Peruvian Mid-Scale Mining Activities

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Abstract. This paper illustrates how the Bieniawski rock mass rating geomechanics classification, within the support system used by medium-scale mining companies, allows for the development of a new anchor rock bolt selection method aimed at improving horizontal access stability in underground mines. However, this case study only seeks to select the most efficient anchor rock bolt for any given horizontal access. A proper support selection method is very important for mining companies because this decision will safeguard both miners and mining infrastructure. This selection process will ultimately prevent fatal accidents, which is critical for mining companies today, especially considering the constant operation standstills reported in Peru.

Keywords: Rock mass rating · Medium-scale mining · Bieniawski's classification · Stability increase · Anchor rock bolts

1 Introduction

In Peru, from 2000 to 2018, more than 100 accidents have been recorded with respect to support in underground workings (rock falls) and the highest percentage of these accidents have occurred in small- and medium-sized mining, besides craft mining, due to the precarious nature or rough support used in this sector. In fact, most of these mining operations use timber supports, either as square sets, timber sets that form a type of passive support, or props, which mostly serve to build mine tunnels in areas that are too narrow to place square sets. However, the use of timber leads to complications, such as supply issues due to the considerable paperwork and several permits needed to cut timber and transport it to the mine site. In addition, timber supports need to be transported

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within the mine, which may require several people and take considerable time depending on the mine level where the timber is needed, and thus, generate significant delays for the mining cycle [1]. Another issue would be the considerable time required to assemble the square sets or place the props in their corresponding locations. Here, the support specialist has to prepare all materials and exercise enormous pressure for each timber piece to fit perfectly in place to prevent rock falls. Besides the high costs of using timber, there are also indirect costs, represented by the amount of time spent in each stage, procurement, transportation, and installation, as well as that required for building these supports, which also affect the mining cycle [2]. Still, the most important issue that urges us to conduct this academic study is the instability generated when using timber in wetlands, as water causes timber to break or fracture, which means that the timber supports would need to be replaced at a heavy cost and additional time.

2 State of the Art

2.1 Selection of Active Supports in Mining or Related Sectors Using the Bieniawski Rock Mass Rating (RMR)

To effectively select a support system, we must first know the RMR geomechanics classification, which has been modified and become the International Standard for rating rock masses. This rock mass classification was first developed by Bieniawski in 1973 and amended by the same author in 1976 and 1989. The RMR uses five core parameters (items 1 to 5) and one control parameter (item 6) to classify the rock masses under its rating system. The five core parameters include uniaxial compressive strength (UCS), rock quality designation (RQD), spacing of discontinuities, condition of discontinuities, and groundwater conditions. Then, we have the corrections, such as the orientation of discontinuities, as the last parameter [9, 11, 13]. Being able to select the most efficient support system translates into preventing the possible deaths, injuries, and equipment losses in medium-scale underground mines. Mines require special attention in terms of stability issues generated by rock mass features. The need for reliable and easy-to-use engineering tools arises in the same measure as they contribute to improving job safety. These tools must cover both structurally controlled faults (e.g., flat, wedge, and block toppling) and circular faults. The empirical rock and slope quality classification systems seem to be the most practical solution for the preliminary analysis of structurally controlled faults [10, 12].

2.2 Selection of Active Supports in the Mining or Related Sectors Using the Bieniawski RMR Geomechanical Classification and Barton's Q-System for Tunnel Quality

Underground mining operations are expected to operate at the lowest possible costs, which include using anchor rock bolts to provide rock stability supports. However, these expectations can only become real through an improved understanding of the rock mass (RMR) and Q-system conditions [19]. As such, rock mass classification systems provide further information regarding rock mass conditions, e.g., onsite fault criteria,

rock properties, uniaxial compressive strength, Young's modulus, and Poisson's ratio, which facilitate a better selection of anchor rock bolts according to each specific scenario. Rock mass characterization systems are empirical characteristics using a two-model approach: the RMR as the general model and Barton's Q-system as a specific model. Both require direct and indirect inputs of the rock mass parameters and can be applied to limit the rock type range for selecting an anchoring system based on the characterization of rock mass conditions [19, 20, 21].

3 Contribution

3.1 Proposed Model

See Fig. 1

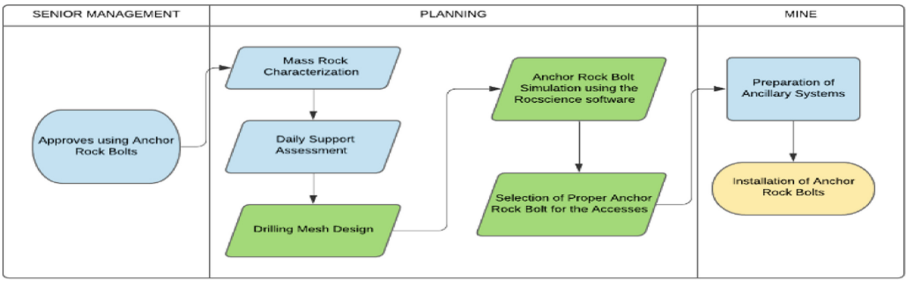

Fig. 1. Research application process flow

3.2 Proposed Methodology

Geological-Geotechnical Survey of the Rock Mass. The assessment will be conducted using geomechanical stations, known as cell mapping, along all exploitation levels and sub-levels. In each station, the features of the main families of discontinuities will be identified and quantified. The following features are determined for each family: orientation (dip "Bz" and dip direction "DBz"), spacing, persistence, roughness, discontinuity wall strength, hole, filling, weathering effects, filling strength, and the presence of water. In addition, block shapes, size range, and volume of the blocks are identified.

Control of the Anchor Rock Bolt Installation (Support Mesh). After completing rock mass characterization and determining that using Hydrabolt rock bolts for support is indeed feasible, a drilling mesh will be designed to identify the location of the Hydrabolt rock bolts along the tunnel. This design will be aligned with the mining standards established for this support method.

Apply the Method of Support Based on the Anchor Bolts Along the Mine Site. After completing the rock mass characterization and finalizing drilling mesh determination,

the anchor rock bolts are installed using a jackleg drill and a hydraulic water pump, which is used to expand and adjust the rock bolt to the shape of the hole. All installation times and data will also be recorded to keep track of the process. Once installed, a pull-test will be conducted to determine the strength of the rock bolts.

Stress/Deformation Analysis using the Rocscience Software. Next, the anchor rock bolt installation data collected are compared against the timber support strength data gathered from our literature review using the Rocscience software, to determine which of the two support methods is more effective for securing access to the mining site.

3.3 Indicator View

The indicators used in the anchor bolt selection methodology are simplified as follows:

Rock Mass Indicator According to NGI (Q). Having already calculated the RMR, the rock mass classification issued by the Norwegian Geotechnical Institute (NGI)

$$\mathrm{RMR} = (9 * \mathrm{LnQ}) + 44 \tag{1}$$

Equivalent Dimension (De). This dimension is calculated to relate the Rock Tunneling Quality Index (Q) to the excavation support ratio (ESR) to certify that an adequate support system is being used. The De value is calculated as follows:

$$\mathrm{De} = \frac{(\text{Excavation width (m)})}{(\text{Excavation Support Ratio (ESR)})} \tag{2}$$

4 Validation

4.1 Case Study

The Poderosa Mining Company operates in Anexo de Vijus, district and Province of Pataz, department of La Libertad, at a height ranging between 1300 and 3300 m above sea level. The mine is geographically located on the right bank of the Marañón River or on the eastern flank of the Northern Andes Mountain Range.

4.2 Application of the Method to the Case Study

Hydrabolt Anchor Rock Bolts. The Hydrabolt is an active mechanism friction rock bolt injected with high-pressure water (25–30 MPa). The bolt expands from an initial diameter of 29 mm to 42 mm, and due to a check valve, which prevents the internal filling liquid from being released. The water then exerts pressure radially throughout its length (Figs. 2 and 3).

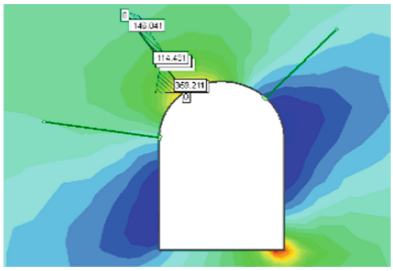

Fig. 2. Hydrabolt rock bolt based on its axial force

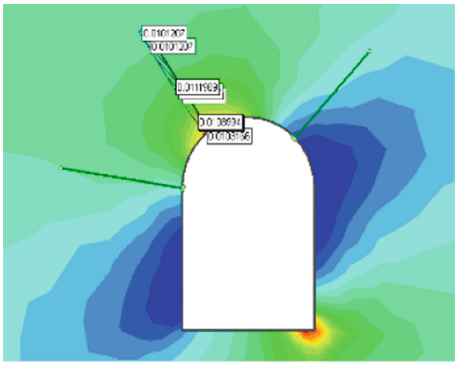

Fig. 3. Hydrabolt rock bolt based on its displacement

Split Set Anchor Rock Bolts. These anchor rock bolts exhibit a simple design and are as easy to install as the other bolts. In addition, they are affordable and do not require any adjustment. The proper positioning of this bolt is measured visually through its behavior, i.e., how the bolt acts on the rock mass immediately after its installation. In addition, the load is transferred along the entire bolt length, which allows water to drain from the access walls (Figs. 4 and 5).

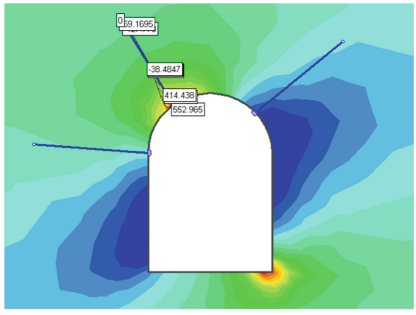

Fig. 4. Split set rock bolt based on its axial stress

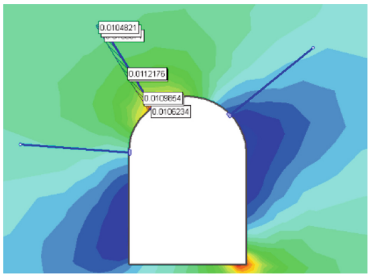

Fig. 5. Split set rock bolt based on its displacement

Swellex Anchor Rock Bolts. The Swellex anchor rock bolt is sealed at one end, while the other end is equipped with a special nozzle used for inflation. The bolt expands inside the borehole, creating friction and an interconnected anchor, which provides support to the entire column and throughout the length of the hole. Consequently, due to this anchoring mechanism, the Swellex rock bolt can be attached to a wide variety of rocks and deliver good-to-excellent anchoring capacity. Its steel profile can adapt stripping movements without failure. In addition, its performance can be explained through its very simple system (Fig. 6).

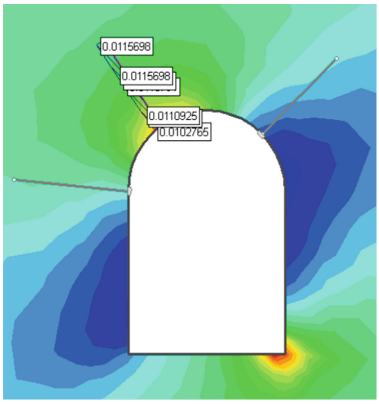

Fig. 6. Swellex rock bolt based on its displacement

5 Results

This study confirms that the installation of anchor rock bolts will generate greater physical stability for horizontal mining works, which previously used timber supports. Rock bolt strength was measured through the pull test. To perform this test properly, a geomechanical mapping was conducted to identify the rock type and determine whether the support installed was viable. According to the GSI, the rock was classified as LF/MB (slightly fractured/very good), LF/R (slightly fractured/regular), and F/R (moderately fractured/regular). Therefore, under these rock mass conditions, Hydrabolt anchor rock

bolts can be perfectly used. In this study, a geomechanical characterization was calculated in a horizontal section of a sterile material (cruise) every 3 m, resulting in an RMR of 46 to 50, which means that the rock is type II (good rock). using anchor rock bolts was optimal due to the rock and excavation type. Still, since both the RMR and GSI are different and not accurate, they must be supplemented by the results from the pull test. Huamani (2014) performed the pull test on a rock type IV (bad), with an RMR of 31.40 and a GSI classification of MF/P.

6 Conclusion

The Poderosa Mining Unit is a medium-scale extraction unit that uses timber supports in its permanent accesses and galleries. However, Hydrabolt anchor rock bolts have provided better results and greater stability for the development of accesses within the mine.

In the geological survey of the rock mass and the classification of the rock, and based on the RMR calculated, the rock is type III (regular rock), and as per the Barton, Lien and Lunde table, access supports are required. For these purposes, anchor rock bolts will be used.

The expansion system of the Hydrabolt rock bolt provides permanent, active, and effective support. Likewise, its load capacity provides a greater safety factor than another support system, due to a check valve that prevents the internal filling liquid from being released. The water then exerts pressure radially throughout the length of the borehole.

References

1. Sociedad Nacional de Minería Petróleos y energía: Manual de Geomecánica. Lima: INGEMMET (2004)
2. Maldonado, L.: Sostenimiento subterráneo con pernos de anclaje Hydrabolt. Rev. Minería IIMP (2012)
3. Giraldo, M.: Variabilidad de la capacidad de sostenimiento de un macizo rocoso Vs longitud de pernos de roca. Estudio de Investigación Facultad Ingeniería de Minas UNSM (2013)
4. He, L., An, X.M., Zhao, X.B., Zhao, Z.Y., Zhao, J.: Development of a unified rock bolt model in discontinuous deformation analysis. Rock Mech. Rock Eng. **51**(3), 827–847 (2018). https://doi.org/10.1007/s00603-017-1341-9
5. Nicholson, L., Hadjigeorgiou, J.: Interpreting the results of in situ pull tests on Friction Rock Stabilizers (FRS). Min. Technol. **127**(1), 12–25 (2018). https://doi.org/10.1080/14749009.2017.1296669
6. Li, C.: Analysis of inflatable rock bolts. Rock Mech. Rock Eng. **49**(1), 273–289 (2016). https://doi.org/10.1007/s00603-015-0735-9
7. Forbes, B., Vlachopoulos, N., Hyett, A.J., Diederichs, M.S.: A new optical sensing technique for monitoring shear of rock bolts. Tunneling Underg. Space Technol. **66**, 34–46 (2017). https://doi.org/10.1016/j.tust.2017.03.007
8. Li, Y., Li, C., Zhang, L., Zhu, W., Li, S., Liu, J.: An experimental investigation on mechanical property and anchorage effect of bolted jointed rock mass. Geosci. J. **21**(2), 253–265 (2017). https://doi.org/10.1007/s12303-016-0043-8
9. Haines A, Terbrugge, P.J.: Preliminary estimation of rock slope stability using rock mass classification systems. In: Proceedings of the 7th Rock Mechanics Congress. International society of Rock Mechanics, Aachen, Balkema, pp 887–892 (1991)

Mathematical Model of a Drilling Mesh to Reduce Dilution in the Sublevel Stoping Method in Peru's Underground Mines

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Abstract. This research study focuses on creating a drill pattern for the Condestable mine, which will allow us to assess the percentage of dilution. For these purposes, we used the Pearse formula proposed in 1955, which allowed us to find the burden and later, the spacing that each drill hole should have in the pattern. Once we had collected all the numerical data, we used the JK SimBlast program to design the proposed drill pattern and analyze the damage zones, the tonnage acquired and the existing dilution. According the results obtained, the smaller the hole diameter, the less dilution will be generated when diversifying the wall and ceiling explosives.

Keywords: Dilution · Sublevel Stoping · Fragmentation

1 Introduction

The mining industry is one of the most productive markets in the world, as is the case in Peru. In the last 10 years (2009–2018), this industry generated 20% of corporate tax, royalties and special taxes [1]. Mining in Peru is one of the main drivers of its economy. Most of the mines are concentrated in the Andean region, and the main products are silver, copper, gold, zinc, tin, bismuth and tellurium. There are several methods of exploitation, your choice will depend on the type of local rock mass, the expected degree of fragmentation and the minimum dilution percentage used to obtain the maximum profitability of the project. Since prehistoric times, several tools have been used to extract ore, over the centuries, these techniques were improved. However, other problems arose, which can now be overcome thanks to technology.

In underground mining, rock fragmentation is the beginning of a long process to recover the mineralized deposit. There are many drilling and blasting techniques to optimize rock fragmentation, such as numerical models, contact zone studies, drill pattern

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designs, among others. Analyzing the percentage of dilution in blasting is critical for a mining company because it directly affects the percentage of mineral ore which may be recovered.

This article focuses on the design of a drill pattern for the sublevel Stoping underground mining method, aimed at optimizing the recovery of the mineral ore. The existing direct relationship between the dilution of the economic ore and the degree of rock fragmentation will also be discussed. The dilution directly and significantly influences metal processing costs, and ultimately, the profitability of the entire mining operation. Therefore, assessing the existing relationship between the dilution, fragmentation and mineral ore recovery is critical [2]. The design of a drill pattern will be detailed based on empirical calculations as per the formula proposed by Pearse in 1955. From geological samples of the mineralized deposit, the burden and spacing will be calculated as per ground characteristics. Then, the pattern will be designed, and the results will be contrasted using the JK SimBlast program.

2 State of the Art

2.1 The Sublevel Stoping Exploitation Method

There are several exploitation methods in underground mining. Sublevel Stoping is one of the blasting methods used for large deposits. This technique is characterized by a high percentage of dilution of 15 to 20%. However, in some cases more sterile material falls than mineral ore, thus generating low recovery rates and increasing the costs of separating and dismantling the mineral ore. Therefore, this represents a serious issue when using this particular method of exploitation, which currently uses fan cut drill patterns because it is based on breaking the free face or front of the tunnel. This pattern consists of making a wedge cut from one of the sides of the tunnel to arrange the drills in the form of a fan that diverges at the bottom. However, its use is uncommon in other methods because it requires a certain width to obtain an acceptable progress [3, 4].

2.2 Drill Pattern Design

To conduct the drilling stage, the planning area designs a drill pattern according to the soil where the work is to be performed. For the design, collaboration between the geology and geomechanics area is essential, as they will provide all the rock mass information required, such as the presence of faults, dams, dimensions of the deposit, type of rock, the structure of the crust, and study and interpretation of the layers. These data will be used to design the pattern using mathematical calculations to assess the correct span between boreholes. For these calculations, Pearse's formula will be used to determine the burden (the shortest distance from the drill to the exposed rock face, measured perpendicularly to the nearest borehole) [1, 6].

3 Contribution

3.1 Proposed Model

As mentioned by several authors, the design of the drill pattern is critical for the drilling stage. The calculation of burden (B) is critical for determining the optimal span between

boreholes as it provides the distance measured perpendicularly from the center of gravity of a loaded explosive mixture inside a borehole to the nearest exposed rock face, as well as the direction in which rock mass displacement will likely occur. In addition, since the blasting principle is based on the drill pattern used, creating the cut or burst cavity is critical for creating the second exposed face, thus facilitating breakage for the rest of the section. The design of an optimal drill pattern will indicate the correct distribution of the drills detailing borehole span, explosive loads and the sequence in which they should be fired. By optimizing section design, the contact between mineral ore and sterile material is reduced. This action favors the control of the dilution that could be generated in the mineral ore exploitation process. For these purposes, the following process flow chart details the steps for designing a new drill pattern (Fig. 1).

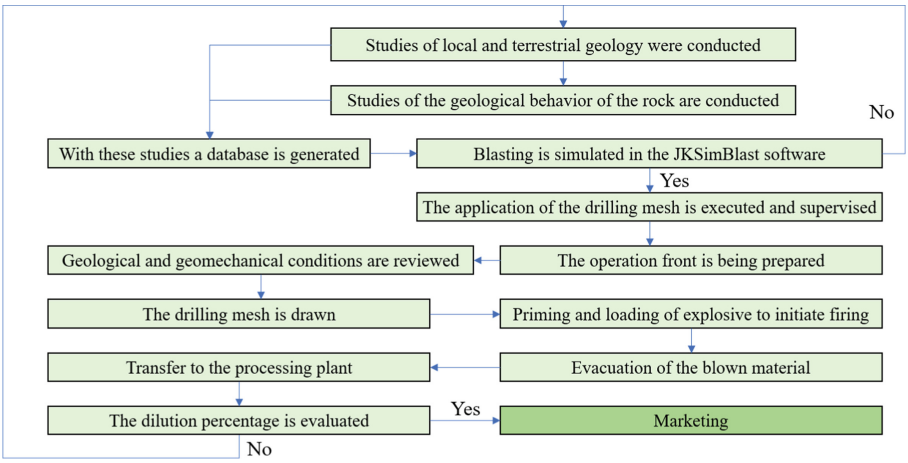

Fig. 1. Research application process flow

3.2 Burden Calculation

The burden is the shortest distance from the drill to the exposed face of the rock, measured perpendicularly to the nearest borehole. In other words, the span between boreholes in the blast. In 1955, Pearse proposed the following formula based on the properties of the rock, the diameter of the borehole, the detonation pressure, and the dynamic strength of the rock.

$$B = Kr \times Dt/12 \times \sqrt{PD/RD} \quad (1)$$

Where:

Kr: Constant depending on rock property
D: Borehole diameter (mm)
PD: Detonation pressure of the explosive (Kg/cm^2)

RT: Rock tensile strength (Kg/cm^2)

a) The constant is found based on the quality of the rock

$$Kr = 1.96 - 0.27 \times \ln(ERQD) \tag{2}$$

Where:

ERQD: Equivalent Rock Quality Index (%)

$$ERQD = RQD \times JSF \tag{3}$$

Where:

RQD: Deer Miller´s Rock Quality Index
JSF: Joint Strength Correction Factor

b) Next, we calculate the detonation pressure according to the explosives used
c) We find the rock´s dynamic resistance

- Tensile strength (St) based on uniaxial compressive strength

$$St = 8\% \times Sc \tag{4}$$

Where:

St: Static tensile strength (MPa)
Sc: Uniaxial compressive strength of the mineral (MPa)

- Dynamic tensile strength (Std) based on the static tensile strength

$$Std = 4.5 \times St \tag{5}$$

Where:

Std o RT: Dynamic tensile strength
4.5: Conversion constant of static strengths into dynamic strengths.

4 Validation

4.1 Case Study

The proposed pattern design was developed based on geological and geomechanically data from the Condestable mine, located in the Mala district, department of Lima in Bujama Alta, at Km. 89.5 on the old southern Pan-American road. Enclosed in volcanic and sedimentary rocks dating from the lower cretaceous and rocks in dams, and quartz-diorite stocks, the Condestable site produces copper (Cu) and gold (Au) mineral ore.

After identifying the different pattern designs obtained with the JK SimBlast software, we proceeded to estimate the tonnage and the dilution percentages that will be produced from each pattern.

4.2 Option 1

Drill diameter: 2.5 inches - Type of explosive: Emulsion (Fig. 2 and Table 1)

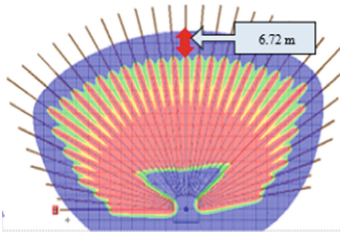

Fig. 2. Drilling design with only one type of explosive

Table 1. Parameter for calculating the Burden with Emulsion – 2.5 inches

EMULFAN 600S (D = 2.5 inches)			
Parameters			
RQD	Rock quality index	63	
JSF	Effort reduction factor	0.9	
ERQD	RQD * JSF	56.7	
K	1.96 - 0.27 In (ERQD)	0.869800963	
PD	Explosive detonation pressure (Emulex 8)	10 700	MPa
RD	Rock's dynamic strength	50.4	MPa
D	Drill diameter (mm)	2.5	inches
BURDEN	(Kx(Drill D.)/12)*(PD/RD)1/2	2.64031	Feet

We found the initial tonnage for comparison against the tonnage obtained from pattern type 1:

$$\text{TN} = 3.5\,\text{m} \times 3.5\,\text{m} \times 16.26\,\text{m} \times 2.8\,\text{TN/m}^3 = 557.718\,\text{TN}$$

The blast produced an overbreak 6.72 m larger than initially planned, then:

$$\text{new TN} = 3.5\,\text{m} \times 3.5\,\text{m} \times (16.26 + 6.72)\,\text{m} \times 2.8\,\text{TN/m}^3 = 788.214\,\text{TN}$$

There is a 230.496 TN excess from the original plan, representing:

$$788.214 = 557.718/(1 - \%\text{Dil})$$

$$\therefore \%\text{Dil} = 29.24\%$$

4.3 Option 2

Drill diameter: 2.5 inches - Explosive types: Emulsion – typo Emulfan 600S and ANFO.

We found the initial tonnage for comparison against the tonnage obtained from pattern type 2:

$$\text{TN} = 3.5\,\text{m} \times 3.5\,\text{m} \times 16.26\,\text{m} \times 2.8\,\text{TN/m}^3 = 557.718\,\text{TN}$$

The blast produced an overbreak 2.24 m larger than initially planned, then:

$$\text{new TN} = 3.5\,\text{m} \times 3.5\,\text{m} \times (16.26 + 2.24)\,\text{m} \times 2.8\,\text{TN/m}^3 = 634.55\,\text{TN}$$

There is a 76.832 TN excess from the original plan, representing:

$$643.55 = 557.718/(1 - \%\text{Dil})$$

$$\therefore \%\text{Dil} = 12.18\,\%$$

4.4 Option 3

Drill diameter: 3 inches.

Explosive types: Emulsion – type Emulfan 600S and ANFO.

We found the initial tonnage for comparison against the tonnage obtained from pattern type 3:

$$\text{TN} = 3.5\,\text{m} \times 3.5\,\text{m} \times 16.26\,\text{m} \times 2.8\,\text{TN/m}^3 = 557.718\,\text{TN}$$

The blast produced an overbreak 4.032 m larger than initially planned, then:

$$\text{new TN} = 3.5\,\text{m} \times 3.5\,\text{m} \times (16.26 + 4.032)\,\text{m} \times 2.8\,\text{TN/m}^3 = 696.0156\,\text{TN}$$

Table 2. Dilution percentage comparison

Explosive	Diameter (in)	Extracted Tonnage	Excess (Tn)	Dilution %
ANFO + EMULSION	2.5	634.55	76.32	12.11
ANFO + EMULSION	3	696.0156	138.2976	19.87
EMULSION	2.5	788.214	230.496	29.24

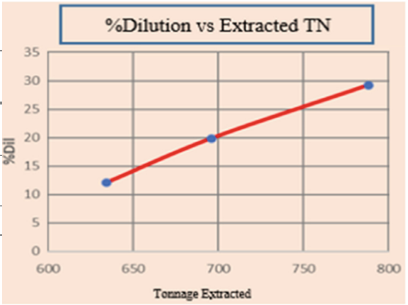

Fig. 3. Dilution Percentage vs Extracted TN

There is a 76.832 TN excess from the original plan, representing:

$$696.0156 = 557.718/(1 - \%\text{Dil})$$

$$\therefore \%\text{Dil} = 19.87\%$$

The results are denoted in Fig. 3.

The figure shows that, as the tonnage rises, either due to an increase in borehole diameter or the type of explosive used, the dilution percentage also increases, thus affecting the recovery of mineral ore.

5 Results

According to the hypothesis proposed and statistical analysis performed with the burden and spacing data collected for the two types of explosives and the different borehole diameters, we can observe that the larger the diameter, the greater the burden. This will favor a damage increase in the cut, which, in turn, will also generate higher dilution. In addition, the type of explosive also plays an important role. The Emulfan 600S explosive has a higher degree of detonation when compared against the Anfo. The burden and spacing, therefore, are higher as the drill diameter increase. This indicates that the choice of explosive is fundamental and would depend on the degree of fragmentation intended and the type of terrain where the work is performed (Table 2).

6 Conclusion

This research study concludes that the proposed drill pattern design for the Sublevel Stoping – Long Drills underground mining method favors the amount extraction tonnage. The tables indicate that, as tonnage increases, either because of the type of explosive used or borehole diameter, the rock mass will experience greater damage, thus leading to a higher dilution percentage. When using a diameter of 2.5 inches and the type of explosive emulsion – emulfan 600S, 12.11% dilution is obtained: less than only using Emulsion for the hanging walls and footwalls (%Dil = 29.24%).

It is also concluded that determining the load is a key factor for the drilling design. The statistical tables shown indicate the optimal borehole diameter for this investigation. In addition, the type of explosive used determines the value of the charge according to its degree of detonation. This data will be used to calculate the required interval between perforations and design the optimal perforation pattern.

Table 2 shows that the type of explosive used during the exploitation stage is another critical factor for the fragmentation of the rock mass. In this case, rock mass fragmentation will depend on the hardness of the rock, the degree of fragmentation required, whether there is presence of water, and borehole diameters. Its use must be done strategically, carefully distinguishing the overbreak that could be generated in the hanging and side walls. This research used two types of explosives, Emulfan 600S for the side walls, and ANFO for the hanging walls to avoid the rock from collapsing due to gravity.

References

1. BCRP: Memoria 2018 (2018). http://www.bcrp.gob.pe/publicaciones/memoria-anual/memoria-2018.html. Accessed 11 Sept 2019
2. Mishra, A.K., Rout, M., Singh, D.R., Jana, S.P.: Influence of gassing agent and density on detonation velocity of bulk emulsion explosives. Geotech. Geol. **36**, 89–94 (2018)
3. Ghasemi, E., Sari, M., Ataei, M.: Development of an empirical model for predicting the effects of controllable blasting parameters on flyrock distance in surface mines (2012). https://doi.org/10.1016/j.ijrmms.2012.03.011
4. CIDEAD: Minerales y rocas (2001). http://recursostic.educacion.es/newton/web/materiales_didacticos/EDAD_1eso_07_minerales_y_rocas/contenido/1q7/pdf/quincena7.pdf
5. Ortiz, C.J.C.: Explotación de Minas. Facultad de Ciencias Físicas y Matemáticas, Departamento de de Ingeniería En Minas, pp. 271–338 (2011)
6. Mishra, A.K., Rout, M., Singh, D.R., Jana, S.P.: Influence of gassing agent and density on detonation velocity of bulk emulsion explosives. Geotech. Geol. (2018)

Education

Comprehensive Internationalization at HAN University of Applied Sciences. Faculty Policies and Practices

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Abstract. This article is concerned with how the "Faculty Policies and Practices" dimension of the Center for Internationalization and Global Engagement's (CIGE) Comprehensive Internationalization Framework [1] applies to Arnhem Business School (HAN University of Applied Sciences), the Netherlands. According to the model, institutional policies and mechanisms of support enhance the faculty opportunities to develop international skills and can maximize the impact of these experiences on student learning while helping identify implementation strategies that support internationalization at the university level. Based on the targeted expert interviews at Arnhem Business School (ABS), tenure and promotion policies, hiring guidelines, faculty mobility and on-campus professional development will be documented, assessed and disused in terms of policies, practices, actions and outcomes in line with the university internationalization goals. In order to introduce internationalization as a key pillar such criteria are globally focused and interlinked with various "glocal" stakeholders to enhance the ABS personalized internationalization strategy.

Keywords: Comprehensive internationalization · Internationalization policies · Higher education · Internationally connected university

1 Introduction

Even if the trends in the internationalization of higher education are seen as widely achieved, it should be highlighted that different perspectives towards internationalization process may be observed [2–4]. For example, there are observers that have pointed out that the accentuation falls on the economic and political values to the detriment of traditional academic and cultural values of higher education regarding internationalization. Also, there are observers that highlighted that more and more the higher education institutions have focused on "competition" in the detriment of "cooperation" [5].

Scott (2015) discusses about the expression "hegemonic internationalization" since he observes that there is a growing undercurrent of internationalization policies, namely a nationalistic or imperialistic undercurrent [6]. Based on this undercurrent, one country can be successful by gaining financially, politically and economically and have success relying on the smart activities and policies regarding internationalization of other

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countries. Moreover, Rhoades (2017) highlight that there is a growing current of "anti-internationalization" that affects the policies of higher education institutions [7]. Despite the fact that at this moment the economic benefits and competition are the fundamental objectives, on long-term it is quite difficult to analyze how the actual activities and policies are in accordance with this kind of rhetoric. Other scientific contributions state that severe criticism of the economization is prevalent in the academic environment since this approach is often expressed, as for example "from the pursuit of knowledge to the pursuit of revenue" [8, 9]. Moreover, other scholars affirm that institutional strategies and concepts regarding the internationalization process vary significantly, according to several surveys of university leaders' perspectives [10] and international policies have also significant differences between countries [11, 12].

Every institution has unique guidelines, documentation and promotion process regarding internationalization. Moreover, internationalization plays a unique and different role for each campus. There are not even two identical internationalization policies. In order to highlight the importance and significance of each event, whether it is international, national, regional or local (thus "glocal"), each faculty has to submit their accomplishments into an organized, succinct and clear way related to professional and scholarship research or development and productivity. This is why this article is so relevant and its impact on learning from best practices is obvious.

2 Faculty Policies and Practices

Following the "Faculty Policies and Practices" dimension of the CIGE model, strategic planning involves key stakeholders that articulate an institution's commitment to internationalization and provides a roadmap for implementation. Formal assessment mechanisms reinforce this commitment by framing explicit goals and holding the institution accountable for accomplishing them [1].

Step 1: Tenure and promotion policies. Tenure codes state explicitly that international work and experience should be considered in tenure and promotion decisions.
Step 2: Hiring guidelines. International background, experience and interests are among the criteria upon which faculty candidates are evaluated.
Step 3: Faculty mobility. Faculty have opportunities to teach, conduct research and attend conferences abroad. Administrative and funding mechanisms support faculty participation in outside programs (e.g. Fulbright).
Step 4: On-campus professional development. Workshops, seminars and other programs help faculty build international competence and incorporate international perspectives into their teaching.

In line with the model mentioned, taking into account the explorative nature of the study, the researcher chose a combination of targeted expert interviews at Arnhem Business School, archives, and observations, with main emphasis on the first two (same methodology used for previous articles regarding comprehensive internationalization at Arnhem Business School, the Netherlands), [13–17].

Regarding the tenure and promotion policies, Arnhem Business School (ABS) has chosen to use the Hay method when organizing organizational functions from the international consultancy organization Hay Group [18]. The Hay method, designed in 1943, is widely used in very different organizations worldwide. The starting point of the Hay method is formed by two questions. Why does a function exist and how does it contribute to the goals of an organization? and Where in the organization and within which frameworks does a function contribute? Form the basis of this system of job orders, there are groups of functions that, based on their role in the organization, contribute to fit together. At Han, the job profile plays an important role in determining the level of a job. That level is also determined by classification criteria based on the Hay method for job evaluation and profiling. If the weight in a result area differs or if there are variants leveling up a position, this is reflected in those classification criteria.

Although the Hay procedure is fully described in Dutch and not sufficient explained by the supervisors for international personnel members in English, the Human Resources Department started in the academic year 2018-2019 an thoroughly analysis of the procedures for international staff members and their needs. Various stakeholders were engaged (the Faculty Dean, the management team, the international relations office responsible for internationalization policies at the faculty level and the new international staff members) and new policies were developed and implemented. Benchmarking with ABS worldwide partner universities and other international recruitment bodies were consulted, as "glocal" stakeholders are eminent in creating the personalized nature of ABS strategies on internationalization.

While the tenure and promotion policy is under review and development, the Hiring guidelines procedure for Non-European Union has been created based on before and after 6 months period Feedback, regarding issues as immigration, recruitment procedures, local government appointments, diversity and culture matters, housing, insurance, pension and other "HAN domestic issues".

The new Hiring Procedure for Non-European Union personnel is using a mix of stakeholders involved in this process with clearly specified and defined roles within the 24 steps new procedure guidelines [19]:

- Candidate (C);
- Expat Centre (E);
- HR advisor HAN (HR)
- HR advisor HAN and Collaborator (HR&C);

1. Email Invitation for an employment interview with a HR Advisor (HR); the candidate must read the documents before the interview meeting and send the required documents to the HR advisor in advance (C);
2. Employment interview with the HR advisor via Skype, WhatsApp or telephone will take place (HR&C);
3. Confirmation of the conditions of employment will be sent by email (HR);
4. HR contact the Expat Centre Wageningen to start the procedure for Entry and Residence (HR);
5. Expat Centre informs the candidate about the procedure and documents needed to be provided (E);

6. Expat Centre checks the documents provided, if everything is in order, they file the application with the Immigration and Naturalization Service (IND), (E);
7. HR supervisor contacts the candidate to specify the date of the commencement of the employment (HR);
8. Expat Centre informs the candidate and HAN when they receive an approval for the entry and residence procedure (E);
9. Expat Centre informs the candidate at which Embassy to pick up the visa (E);
10. The candidate sends a copy of the visa to the Expat Centre informing the date of arrival in the Netherlands (C);
11. First meeting at the Expat Centre in the Netherlands is planned (E);
12. HR checks is the candidate can benefit of the 30% tax facility (HR);
13. Start finding a home in the Netherlands (rent of buy), (C);
14. Appointment with the HAN supervisor take place at the HAN office (HR&C);
15. First meeting at the Expat Centre Wageningen to arrange: receiving a BSN number for the municipality; opening a bank account; receiving the residence permit from IND; if necessary arranging a TBC health appointment; (C&E);
16. The candidate receives a welcome guide presentation from the Expat Centre, list of steps to be taken and the digital personal file (E);
17. Home in the Netherlands arrangements continue with connecting to the water and electricity supply facilities; internet connections etc. (C);
18. Appointment with the HAN supervisor take place at the HAN office (HR&C);
19. The Expat Centre notifies the HR advisor about the BSN number, bank account number (IBAN), so HAN can draw up the contract (E);
20. HR sends the contact the candidate Dutch address; a signed contract copy will be returned to the HAN by the candidate (HR&C);
21. The candidate creates a Han account and apply for a HAN card; procedures how to apply are explained in a separate document (C);
22. Arrange an Health Insurance within the first 3 months of the employment (C);
23. Read the welcome guide about living in the Netherlands paying extra attention to the finance chapter social security and allowances (C);
24. For traveling by bike, car or public transportations procedures see important issues surrounding your employment guide and enjoy your first day at Han University of Applied Sciences (C);

Every year the Personnel Policy Steering Group discusses the HAN Function Scheme and advises the Executive Board on enforcement or adjustment, through the HR director who is responsible for this agenda. Still, it is quite clear to mention that at ABS the tenure codes and hiring policies state that international work and experience are considered in tenure, promotion and hiring decisions very explicitly.

The professional development on Campus of the staff members at ABS is quite elaborate as all the teaching staff members are obliged to have their teaching and examining qualification certificates by 2020 [19] where workshops, seminars and other programs help faculty build international competence and incorporate international perspectives into their teaching. Also new projects on the internationalization of the curriculum and the international programme offered are being held at the moment where interaction of different faculty and glocal stakeholders is highly valued. The professionalization of the

teaching staff members is seen as a priority for the ABS management as ABS has started to implement internationalization as a core institutional priority aiming to prepare the faculty members for both life and work in the globalized world that describes the 21st century [20]. HAN plays the role of the institutional driver in learning and teaching students in this globalized world. Higher education institutions as the HAN, must be interested to include international perspectives and experiences as part of their curriculum and co-curriculum in order to reach the level of global competency and help not only students but teaching staff members as well to achieve global competence by gaining international knowledge and skills [21].

Faculty mobility at the ABS can be described as intensive as many of the faculty members have opportunities to teach, conduct research and attend conferences abroad via the "Preferred Partners Policy" [20]. For the academic year 2018–2019 international research and co-teaching projects have been taken place to boost the internationalization strategy cooperation not only with European partners but as well with partners from India, USA, Russia and Indonesia. Relevant is to mention that not only the teaching staff is involved in mobility projects, but also administrative staff and management.

3 Conclusions and Further Recommendations

By starting in the early stages of faculties' careers, the consolidation of a global focus among faculties sets the stage for a continued interest and activity in the international domain. On the long-term this will help the institutions to build up from the ground up a globally engaged professorship. Tenure procedures and policies can represent a powerful mechanism to stimulate and to reward the engagement in internationalization for early-career faculties. This aspect describes those institutions which have made from internationalization a core goal. In order to introduce internationalization as a key goal for institutions, criteria that are globally focused should be incorporated among the standards for promotions. By doing this, the faculty has the license to bring internationalization among the top of the list of competing priorities. Moreover, by bringing internationalization the faculties guarantee that spending time with such activities doesn't affect the tenure prospects of the faculties.

The success of policy changes is dependent on institutional readiness. Higher education institutions have to make an entire and honest assessment of their overall state of internationalization on their campuses before to engage with the tenure code. This assessment is helpful to notify the specific changes that are made by tenure code implementation. Such an evaluation may point out those core domains that need attention in order to build a proper environment where such changes can be achievable in the near future. On the other hand, this kind of evaluation can also reveal that the campus may not be prepared to embrace such tenure policy changes focused on internationalization. There are proactive actions that are necessary to ensure that policies. The "lived reality" of these policies gives the power for the faculty to act as facilitators for the internationalization process. These proactive actions focus on the language that is added to the tenure code, efforts focused to change the review process of international work and also removing the roadblocks to the global engagement.

The faculty has a decisive role in carrying out the activities those are necessary to fulfill the institutional objective related to the internationalization since the faculty

has a central role in the higher education enterprise. Higher education institutions that are truly serious regarding the internationalization have to focus on the intersection of internationalization, tenure and promotion processes due to the central role of promotion and tenure processes of faculty members' choices and careers.

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References

1. American Council on Education (ACE), Center for Internationalization and Global Engagement (CIGE) Model for comprehensive internationalization (2011, 2013)
2. Yonezawa, A., Kitamura, Y., Meerman, A., Kuroda, K. (eds.): Emerging International Dimensions in East Asian Higher Education. Springer, Dordrecht (2014)
3. Wächter, B.: Mobility and cooperation in the European higher education area. In: Kelo, M. (ed.) Beyond 2010: Priorities and Challenges for Higher Education in the New Decade, pp. 13–42. Lemmens, Bonn (2008)
4. Teichler, U.: Internationalisation of higher education: European experiences. Asia Pac. Educ. Rev. **10**(1), 93–106 (2009)
5. Teichler, U.: Internationalisation trends in higher education and the changing role of international student mobility. J. Int. Mobility **5**(1), 177–216 (2017)
6. Scott, P.: Dynamics of academic mobility: hegemonic internationalisation or fluid globalisation. Eur. Rev. **23**(Suppl. 1), 55–69 (2015)
7. Rhoades, G.: Backlash against "others". Int. High. Educ. **89**, 2–3 (2017)
8. Reisberg, L., Rumbley, L.E.: Redefining academic mobility: from the pursuit of scholarship to the pursuit of revenue. In: Maldonado-Maldonado, A. and Basset, R.M. (eds.) The Forefront of International Higher Education: A Festschrift in Honor of Philip G. Altbach, pp. 115–126. Springer, Dordrecht (2014)
9. Kehm, B., de Wit, H. (eds.): Internationalisation in Higher Education. European Responses to the Global Perspective. European Association for International Education (EAIE) and European Association for Institutional Research (EAIR), Amsterdam (2005)
10. Egron-Polak, E., Hudson, R., Sandstrom, A.M.: Quantifying internationalisation – empirical evidence of internationalisation of higher education in Europe. In: de Wit, H., Hunter, F., Howard, L., Egron-Polak, E. (eds.) Internationalisation of Higher Education, pp. 59–76. European Parliament, Brussels (2015)
11. Huisman, J., van der Wende, M. (eds.): On Cooperation and Competition, vol. 2. Lemmens, Bonn (2005)
12. De Wit, H.: The different faces and phases of internationalisation of higher education. In: Maldonado-Maldonado, A. and Basset, R.M. (eds.) The Forefront of International Higher Education. A Festschrift in Honor of Philip G. Altbach, pp. 89–99. Springer, Dordrecht (2014)
13. Popescu, F., Elshof, M.: Comprehensive internationalization at HAN university of applied sciences collaboration and partnerships. Procedia – Soc. Behav. Sci. **237**, 1513–1519 (2017)
14. Popescu F., Helsen E.: Comprehensive internationalization at HAN university of applied sciences. Curriculum, co-curriculum, and learning outcomes. In: Kantola J., Nazir S., Barath T. (eds.) Advances in Human Factors, Business Management and Society. AHFE 2018. Advances in Intelligent Systems and Computing, vol 783. Springer, Cham (2019)

15. Popescu F.: Comprehensive internationalization at HAN university of applied sciences. Administrative leadership, structure, and staffing. In: Karwowski W., Ahram T., Nazir S. (eds.) Advances in Human Factors in Training, Education, and Learning Sciences. AHFE 2019. Advances in Intelligent Systems and Computing, vol 963. Springer, Cham (2020)
16. Popescu F.: Comprehensive internationalization at HAN university of applied sciences: articulated institutional commitment. In: Kantola J., Barath T., Nazir S. (eds.) Advances in Human Factors, Business Management and Leadership. AHFE 2017. Advances in Intelligent Systems and Computing, vol 594. Springer, Cham (2018)
17. Popescu, F., Geessink, J.: Comprehensive internationalization at HAN university of applied sciences. Student Mobility, pp. 520–527 (2016). https://doi.org/10.15405/epsbs.2016.12.64
18. HAN University of Applied Sciences: Procedure for Changing or Introducing Hay Profile
19. HAN University of Applied Sciences: Non-EU Expat Hiring Procedure
20. HAN University of Applied Sciences: Strategical Internationalization Agenda 2016–2020
21. HAN University of Applied Sciences: Institutional Plan 2016–2020

Sustainable Development in Higher Education

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Abstract. Public discussion on the role and responsibility of higher education institutions in shaping society of the future began in 2001 [1] The answer to the question of how sustainable development should be understood and what it brings for universities came from the World Commission on Environment and Development in 1987 which described sustainable development as "meeting the needs of the present without compromising the ability of future generations to meet their own needs". The future role of the university should be widely discussed. Education provided outside of higher education institutions should also be considered as important for society. The system of higher education needs reshaping to become more transdisciplinary, open to eliminate barriers and ready for new partnerships.

Keywords: Sustainable development · Higher education · University

1 Introduction

Sustainable development has become a popular and widely cited catchphrase, but it requires an explanation to be properly understood by everyone in the same manner. The term "sustainable development" was and still is used very often by aid agencies, development planners and activists [2]. Without proper explanation it may become a synonym of appropriate technology or just a fashionable phrase used with a lack of precise definition [3].

The idea itself has attracted a vast amount of attention in governance, planning and development as well as in academia. This popularity is owed to the fact that the main global challenges such as climate change, water scarcity, poverty, and many others can successfully be addressed by adhering to the principles of sustainable development [4].

2 The Notion of Sustainable Development

The two words "sustainability" and "development", which together build the phrase, require proper explanation. "Development" means mainly: development as structural transformation, human development, development of democracy and governance and development as environmental sustainability [5]. The second word "sustainability" literally means "a capacity to maintain some entity, outcome, or process over time" [6].

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The meaning of sustainability must be considered only within its ecological aspect in order to be able to create a fundamental framework for the concept of sustainable development [7]. In 1987, the former Prime Minister of Norway and former Director-General of the World Health Organization, Gro Harlem Bruntland, acting as the chairperson of the World Commission on Environment and Development, also known as "The Bruntland Commission", published the report "Our Common Future" [8]. The report creates a link between economic development and environmental stability. In its concluding words the report presented a definition of sustainable development: "*Sustainable development is development that meets the needs of the present without compromising the ability of future generations to meet their own needs. It contains within it two key concepts: the concept of 'needs', in particular the essential needs of the world's poor, to which overriding priority should be given; and the idea of limitations imposed by the state of technology and social organization on the environment's ability to meet present and future needs.*" [9].

As Rachel Emas writes, "The overall goal of sustainable development is the long-term stability of the economy and environment." [10]. In those words, the processes of integration of the economic, environmental and social concerns were emphasized.

At the United Nations Conference in Rio de Janeiro, Brasil in June 2012, during the largest ever meeting of that organization, new goals of sustainable development were widely discussed. Among other challenges, the main global goals should be focused on eradication of poverty, deeper integration of economic, social and environmental aspects, promotion of sustainable patterns of consumption [11].

In 2015 a set of 17 Sustainable Development Goals was created to achieve the eradication of hunger and poverty and the elimination of the worst effects of climate change in ambitious 15 years, until 2030.

3 Challenges for Higher Education Institutions

Universities have a leading role to play in sustainable development and its popularization among stakeholders and in society. The human right for education is rooted in SDG 4 – Sustainable Development Goal 4, which aims to "ensure inclusive and equitable quality education and promote lifelong learning opportunities for all" [12] This declaration is based on Article 26 of the Declaration of Human Rights [13]. It stresses the importance of higher education institutions and their role in sustainable development.

The UN Agenda – UNESCO – the Education for Sustainable Development definition says that education „empowers learners to take informed decisions and responsible actions for environmental integrity, economic viability and just society, both for present and future generations, while respecting cultural diversity" [14].

Due to those obligations higher education institutions should be supported by governments. The allocations of public funds recommended by UNESCO should be between 15%–20% of public budgets. Higher education institutions can contribute to sustainable development in many ways, by generating human capital through spreading knowledge and education, playing the role of research centres and managing the university and its campus in a sustainable way.

In 1972, during the Earth Summit in Stockholm, education was identified as a crucial player in spreading sustainable development. Its role as a supplier of new technology and

knowledge to the wider community is important due to its expertise. Higher education institutions, due to their intellectual resources, have a considerable impact on local societies and their economic relations. University alumni create entrepreneurial power and may lead to economic growth. The role of higher education institutions is to motivate their students to be entrepreneurial [15]. Such a goal requires creating good relations with stakeholders in terms of loyalty and productivity.

One of the main roles of universities is to enhance the quality of research. The results of research, successfully implemented, can bring a positive impact and benefits to local communities [16].

National networks of universities from Italy and Germany showed that sustainability in higher education is strongly linked to committed change agents. It emphasises the role of institutions to create the figure of a student who will play the role of initiator, driver or contributor of the sustainability process [17].

Involvement of students in all key activities of higher education institutions is crucial. The new student-centred system should be further developed in order to allow students to be active co-creators of the curriculum and to make them more responsible for the results of the educational process [17].

Sustainable future requires the involvement of all stakeholders. Universities can act in two ways: first, as indicators of change, as they were created by society and cannot freely promote social change [18, 19]. Second, the university is an active leader of change and creator of societal change [20–22]. The active role is empowered also by the UNESCO statement: "The goal of education is to make people wiser, more knowledgeable, better informed, ethical, responsible, critical and capable of continuing to learn (…). Education, in short, is humanity's best hope and most effective means in the quest to achieve sustainable development" [23].

As sustainable development is not an easy task it requires continuous effort of individuals and organizations to become proficient in dealing with dilemmas in the complex societal settings. In the education process, it would only be achievable by creating an authentic and open learning environment by involving local entrepreneurs collaborating with different higher education institutions to create new policy plans in the area of sustainable development [24].

Also, universities should make an attempt to minimalize the differences in their attitude towards people from poorer societies. More collaboration with the underprivileged people of the world might mean emanation of a truly humanistic approach. Intellectual power and freedom of research should be used to expand such cooperation. A higher level of empathy is postulated as a form of knowledge in its own right [25].

In Universitat Politècnica de Catalunya the transformations towards sustainable development focused on three areas of sustainable development for trained education professionals, solutions for research and a role model for campus operations. Firstly, to become a forerunner in the field of sustainability, the university requires a clear leadership with a strong vision. Secondly, all the processes connected to sustainability need to be centralized [26].

In 1998, in order to develop guidelines for teachers to direct them towards sustainable development in education the Chair on Reorienting Teacher Education to Address Sustainability at York University in Toronto, Ontario, Canada, was established. Research

respondents mentioned the urgency to act by bringing quality education to schools with the goal of answering the main question: "What kind of education would best serve humanity in the future?" and "if education is the solution then it requires a deeper critique and a broader vision for the future" [27].

Another example comes from Mexico, where, at the Monterrey Institute of Technology, Monterrey Campus, efforts were made to use an integrated, multidisciplinary approach to foster and consolidate sustainable development. Its primary points include physical plant operations, research, societal outreach and diffusion. Activities were interconnected to provide synergistic results [28].

In 2001 the Southern African Development Community Regional Environmental Programme (SADC REEP) established a formal Course Development Network. The formal network of six universities, University of Botswana, University of Malawi, University of South Africa, University of Swaziland, Rhodes University in South Africa and National University of Lesotho has a key goal to implement 12 new courses in environmental and sustainability education in southern Africa [29]. For example, "A new participatory in-service course for teachers, developed to support implementation of environmental education policy in Botswana" – in University of Botswana [30], or: "A new course, based on a new qualification, developed as a semi-distance, modular course for in-service and mid-career professionals" – in Rhodes University, South Africa [31].

A report for UK's Higher Education Academy from November 2005 presented the information on then current state of embedding education for sustainable development in disciplines taught within the higher education sector. The report made the following recommendations for the development of ESD across the disciplines research action to be commissioned for employability and groups of stakeholders should be established to support the integration of ESD in teaching, learning and the curriculum [32].

The universities themselves have a lot to achieve in the more sustainable management of their facilities. In the UK, the buildings used by 130 higher education institutions make up a 24.6 million square meters estate that has a massive impact on the natural environment. They are also responsible for consuming 5.2 billion kWh of energy annually, at the cost over £200million; consuming over 16 million cubic meters of water annually; spending £3 billion per year on goods and services; producing thousands of tonnes of waste every year. The staff and students of the universities and colleges are responsible for over 1 million people travelling to work or study every day. That's why, The Higher Education Funding Council for England (HEFCE) - a funder of higher education with resources of £6 billion annually, developed an ambitious strategy for sustainable development, by engaging with stakeholders to bring about the policy synergies, building the capacity of people to manage sustainable development and sharing best practices of sustainable behaviour [33].

The largest and the oldest technical university in the Netherlands – Delft University of Technology strives to educate engineers committed to fully contribute to sustainable development. Command and control as well as interaction and consensus building were adopted as the key factors to introduce sustainable development in engineering [34].

Another idea is to create mobility management centres in a number of municipalities across Europe. Such a project was proposed by the Uppsala University in Sweden under the name of "The Baltic University Programme". The idea was to educate for sustainable

development on all levels of our societies to reach the goal of a sustainable future. That is why the elements of mobility management should be incorporated in educational courses [35].

With a tremendous development of the higher education industry in China after 1990, a big pressure for reforms directed towards sustainable development in higher education was also observed. As the trend of environmental protection become popular, the idea of a "Green University", as the synonym of a site for disseminating and implementing the strategy of sustainable development, was introduced. The pioneer of the Green University was the president of Tsingua University Mr. Dazhong Wang who announced that university of this kind "is centering on education of human beings by implementing the principle of sustainable development and environmental protection in all activities and the whole process of education" [36].

Nowadays, after years of implementation, the Green University is becoming one of the most important directions in higher education reforms in China. That process could also be enhanced by introducing education for sustainable development in primary and secondary schools. Only then could the process have a really great impact on sustainable development in the socio-economic environment in China [37].

In 2000 the Higher Education Partnerships for Sustainability (HEPS) initiative was set up to deliver and spread the strategic sustainable development objectives. In 2003 the first centre of excellence at the University of Plymouth, England, with a focus on education for sustainable development was established. The idea was spread by the governmental action called „Sustainable development action plan for education and skills" [38].

A case study from the Metropolitan Autonomous University campus Azcapotzalco in Mexico City, Mexico shows the very important role of interchange of experience among those in charge and experts in environmental formation. It also presents the difficulty in incorporating that dimension into curricula and programs [39].

Other authors emphasize the role of the university to be creative in developing independent and alternative thinking. In their opinion, sustainable development should not be seen as a goal but rather as one of many drivers for transformative learning. The privileged role of the university within society leads to an obligation to respond to stakeholders' needs in this matter [40].

This complicated process requires several supporting structures. They are: university leaders, key individuals within the university, social spaces for students to show participation and communication, external patrons, self-regulating instruments to provide support for sustainability processes in the longer term, clear criteria of evaluations as well as sustainability centred infrastructure [41].

Three major activities of higher education institutions (research, teaching and serving stakeholders) are obviously and deeply intertwined with the idea of sustainability for higher education [42]. That is the role of universities and with the support from society it may have an impressive impact on our future.

The study on pro-sustainability orientation on a group of 360 students from four universities from Sonora, Mexico, brought clear observations that in all of those institutions it was possible to identify efforts to implement programs for teaching sustainable development [43].

The International Association of Universities (IAU), an organization of about 650 higher education institutions from some 130 countries, launched its first Global Survey on the Role of Higher Education in Fostering Sustainable Development in 2016 [44]. The three main findings are that higher education institutions are increasingly aware of sustainable development issues, which are integrated within higher education institutions, at the strategic level, but still the actions could be improved and higher education institutions are collaborating on those issues, especially at local and national levels.

The results of the survey highlight that the respondents are familiar with the Sustainable Development Goals (78%) and Education for Sustainable Development (74%). They are also familiar with the 2030 Agenda for Sustainable Development (59%) and the concept of the whole institution approach (69%). Most of the respondents claim that sustainable development is linked to environmental issues (84%). At the same time, many also stress the importance of considering societal (68%) and cultural (60%) dimensions when working in ESD. After the survey, a few recommendations were expressed:

- The key role higher education plays in achieving the 2030 Agenda for Sustainable Development should be recognized and supported. Higher education institutions themselves should systematically report on their sustainability initiatives.
- University leaders should support the integration of sustainable development throughout their institutions. They should involve all the institutional stakeholders.

4 Conclusions

Sustainable development in higher education is a crucial point in building a modern society. Changes in societal needs and the growing role of stakeholders force universities to change the way they are governed, the way they manage educational processes and their activity as a whole in order to be able to implement a more sustainable model. Research results and case studies from many countries from all the continents are only a brief presentation of the weight of the problem.

It seems like proper education towards sustainable development in higher education requires further research and deeper observations. The wide familiarity with the term ‘sustainable development’ allows us to predict that change will not be as difficult as it was expected. On the other hand, we must all be aware of the scale of the problem that touches all the scientific disciplines and every institution of higher education around the world. There is no other way but to become sustainable. The process has to involve the university, the students, the staff, the stakeholders as well as all the processes within the institution.

References

1. Drivers and barriers for implementing sustainable development in higher education. In: Holmberg, J., Samuelsson, B.E. (eds.) Education for Sustainable Development in Action, Technical Paper No. 3, UNESCO Education Sector (2006)
2. Ukaga, U., Maser, C., Reichenbach, M.: Sustainable Development: Principles, Frameworks and Case Studies: International Journal of Sustainability in Higher Education, vol. 12(2). Emerald Group Publishing Limited, Bingley (2011)

3. Mensah, J., Enu-Kwesi, F.: Implication of environmental sanitation management in the catchment area of Benya Lagoon, Ghana. J. Integr. Environ. Sci. **16**(1), 23–43 (2019)
4. Mensah, J.: Sustainable development: Meaning, history, principles, pillars, and implications for human action: literature review. Cogent Soc. Sci. **5**(1653531), 1–21 (2019)
5. Vázques, S.T., Sumner, A.: Revisiting the meaning of development: a multidimensional taxonomy of developing countries. J. Dev. Stud. **49**(12), 1728–1745 (2013)
6. Jenkins, W.: Berkshire Encyclopaedia of Sustainability: The Spirit of Sustainabliity, 1st edn., vol. 1, pp. 380. Berkshire Publishing Group, Berkshire, (2009)
7. Klarin, T.: The concept of sustainable development: from its beginning to the contemporary issues. Zagreb Int. Rev. Econ. Bus. **21**(1), 67–94 (2018)
8. https://sustainabledevelopment.un.org/content/documents/5987our-common-future.pdf
9. United Nations General Assembly: Report of the world commission on environment and development: our common future. United Nations General Assembly, Development and International Co-operation: Environment, Oslo, Norway, p. 43 (1987)
10. Emas, R.: The concept of sustainable development: definition and defining principles. Brief for Global Sustainable Development Report, p. 2 (2015). https://sustainabledevelopment.un.org/globalsdreport/2015
11. https://sustainabledevelopment.un.org/futurewewant.html
12. https://sustainabledevelopment.un.org/sdg4
13. https://www.un.org/en/universal-declaration-human-rights/
14. https://en.unesco.org/themes/education-sustainable-development/what-is-esd
15. Goddard, J., Etzkowitz, H., Puukka, J., Virtainen, I.: Supporting the contribution of higher education institutions to regional development. Peer Review Report, Jyväskylä Region of Finland, Paris: OECD (2006). http://www.oecd.org/finland/36809119.pdf
16. Pukka, J.: Mobilising higher education for sustainable development – lessons learnt from the OECD study. In: Proceedings of the 4th International Barcelona Conference on Higher Education, vol. 7. Higher education for sustainable development. www.guni-rmies.net
17. Tafuni, V., Heß, J.: Education for sustainable development as a catalyst and the role of students in the future management of HEIs. http://bolognaprocess2019.it/wp-content/uploads/2019/07/03-keynote_Tafuni_Heß.pdf
18. Althusser, L.: Ideology and Ideological State Apparatuses. L. Althusser Lenin and Philosophy and Other Essays, pp. 121–173. London: New Left Books (1971)
19. Bourdieu, P.: The school as a conservative force: scholastic and cultural inequalities. Roger Dale (ed.) Schooling and Capitalism, pp. 110-117. Routledge and Kegan, London (1976)
20. Coleman, J.: Equality of Educational Opportunity. Washington: US Department of Health, Education and Welfare (1966)
21. Giroux, H.: Against the New Authoritarianism. Arbeiter Ring Publishing, Winnipeg (2005)
22. Jencks, C.: Inequality: A Reassessment of the Effect of Family and Schooling in America. Basic Books, New York (1972)
23. UNESCO: Thessaloniki Declaration. United Nations Educational, Scientific and Cultural Organization, Gland (1997). https://unesdoc.unesco.org/ark:/48223/pf0000117772
24. van Dam-Mieras, R.: Learning for sustainable development: is it possible within the established higher education structures? In: Holmberg, J., Samuelsson, B.E. (eds.) Drivers and Barriers for Implementing Sustainable Development in Higher Education. Education for Sustainable Development in Action, Technical Paper No. 3, pp. 12–18. UNESCO Education Sector, September 2006
25. Eriksson, K.-E.: Empathetic understanding of the existential situation of fellow human beings as a field of knowledge. In: Holmberg, J., Samuelsson, B.E. (eds.) Drivers and Barriers for Implementing Sustainable Development in Higher Education. Education for Sustainable Development in Action, Technical Paper No. 3, pp. 19–22. UNESCO Education Sector, September 2006

26. Ferrer-Balas, D., Cruz, Y., Segalàs, J.: Lessons learned from our particular "Decade" of education for sustainable development (1996–2005) At UPC. In: Holmberg, J., Samuelsson, B.E. (eds.) Drivers and Barriers for Implementing Sustainable Development in Higher Education. Education for Sustainable Development in Action, Technical Paper No. 3, pp. 23-29. UNESCO Education Sector, September 2006
27. Hopkins, C., McKeown, R.: Excepts from guidelines and recommendations for reorienting teacher education to address sustainability. In: Holmberg, J., Samuelsson, B.E. (eds.) Drivers and Barriers for Implementing Sustainable Development in Higher Education. Education for Sustainable Development in Action, Technical Paper No. 3, pp. 30–35. UNESCO Education Sector, September 2006
28. Lozano, F.J., Huisingh, D., Delgado, M.: An integrated, interconnected, multi-disciplinary approach for fostering sustainable development at the Monterrey Institute of Technology, Monterrey Campus. In: Holmberg, J., Samuelsson, B.E. (eds.) Drivers and Barriers for Implementing Sustainable Development in Higher Education. Education for Sustainable Development in Action, Technical Paper No. 3, pp. 36–46. UNESCO Education Sector, September 2006
29. Lotz-Sisitka, H., Lupele, J.: Curriculum transformation in higher education institutions: some perspectives from Africa. In: Holmberg, J., Samuelsson, B.E. (eds.) Drivers and Barriers for Implementing Sustainable Development in Higher Education. Education for Sustainable Development in Action, Technical Paper No. 3, pp. 48–54. UNESCO Education Sector, September 2006
30. Ketlhoilwe, M.: The environmental education participatory in-service course for educators. In: Lupele, J. (ed.) Monograph: Cases of Course Development in Environmental and Sustainability Education in Southern Africa, pp. 35–43. SADC Regional Environmental Education Programme, Howick, South Africa (2005)
31. Timmermans, I.: Designing resources and research opportunities for contextual and workplace-based environmental education. In: Lupele, J. (ed.) Monograph: Cases of Course Development in Environmental and Sustainability Education in Southern Africa, pp. 44–52. SADC Regional Environmental Education Programme, Howick, South Africa (2005)
32. Dawe, G., Jucker, R., Martin, S.: Sustainable development in higher education: current practice and future developments. A report for The Higher Education Academy, November 2005. https://www.heacademy.ac.uk/system/files/sustdevinHEfinalreport.pdf
33. Martin, S., Dawe, G., Jucker, R.: Embedding education for sustainable development in higher education in the UK. In: Holmberg, J., Samuelsson, B.E. (eds.) Drivers and Barriers for Implementing Sustainable Development in Higher Education. Education for Sustainable Development in Action, Technical Paper No. 3, pp. 59–67. UNESCO Education Sector, September 2006
34. Mulder, K.F., Jansen, L.A.: Integrating Sustainable Development in Engineering Education Reshaping university education by organizational learning. In: Holmberg, J., Samuelsson, B.E. (eds.) Drivers and Barriers for Implementing Sustainable Development in Higher Education. Education for Sustainable Development in Action, Technical Paper No. 3, pp. 68–73. UNESCO Education Sector, September 2006
35. Rydén, L.: Education for professional sustainability management competences opportunities and obstacles. In: Holmberg, J., Samuelsson, B.E. (eds.) Drivers and Barriers for Implementing Sustainable Development in Higher Education. Education for Sustainable Development in Action, Technical Paper No. 3, pp. 74–81. UNESCO Education Sector, September 2006
36. Wang, Z., Zheng, Y.: The exploration and practice of establishing Tsinghua University into Green University. Res. Educ. Tsinghua Univ. **1**, 83–86 (2001)

37. Shi, C: Exploring effective approaches for 'education for sustainable development' in Universities of China. In: Holmberg, J., Samuelsson, B.E. (eds.) Drivers and Barriers for Implementing Sustainable Development in Higher Education. Education for Sustainable Development in Action, Technical Paper No. 3, pp. 82–87. UNESCO Education Sector, September 2006
38. Scott, W., Gough, S.: Universities and sustainable development in a liberal democracy: a reflection on the neccesity for barriers to change. In: Holmberg, J., Samuelsson, B.E. (eds.) Drivers and Barriers for Implementing Sustainable Development in Higher Education. Education for Sustainable Development in Action, Technical Paper No. 3, pp. 88–95. UNESCO Education Sector, September 2006
39. Turpin-Marion, S., Espinosa-Valdemar, R.M., Juárez-Nájera, M., Cisneros-Ramos, A.: Barriers for incorporating the environmental perspective into engineering programs in a Mexican University. In: Holmberg, J., Samuelsson, B.E. (eds.) Drivers and Barriers for Implementing Sustainable Development in Higher Education. Education for Sustainable Development in Action, Technical Paper No. 3, pp. 96–102. UNESCO Education Sector, September 2006
40. Wals, A.E.J.: Sustainability as an outcome of transformative learning, in: drivers and barriers for implementing sustainable development in higher education. In: Holmberg, J., Samuelsson, B.E. (eds.) Education for Sustainable Development in Action, Technical Paper No. 3, pp. 103–108. UNESCO Education Sector, September 2006
41. Wickenberg, P.: Norm supporting actors and structures at the very local level of implementation of sustainable development in higher education. In: Holmberg, J., Samuelsson, B.E. (eds.) Drivers and Barriers for Implementing Sustainable Development in Higher Education. Education for Sustainable Development in Action, Technical Paper No. 3, pp. 109–119. UNESCO Education Sector, September 2006
42. Wright, T.S.A.: The role of research in achieving a sustainable future. In: Holmberg, J., Samuelsson, B.E. (eds.) Drivers and Barriers for Implementing Sustainable Development in Higher Education. Education for Sustainable Development in Action, Technical Paper No. 3, pp. 118–125, UNESCO Education Sector, September 2006
43. Tapia-Fonllem, C., Fraijo-Sing1, B., Corral-Verdugo1, V., Ortiz Valdez, A.: Education for sustainable development in higher education institutions: its influence on the pro-sustainability orientation of Mexican students. In: Sage Open, January–March 2017, pp. 1–15
44. The results of the survey were extensively taken from: Higher Education Paving The Way to Sustainable Development: A Global Perspective. Report of the 2016 IAU Global Survey on Higher Education and Research for Sustainable Development. International Association of Universities (IAU), Paris (2017)

Using Effect Size in Evaluating Academic Engagement and Motivation in a Private Business School

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Abstract. This research analyses student engagement and motivation data gathered from a UK-based private business university and multiple European public universities. The data was obtained using an Internet-based generic expert system called Evolute. In this research, the self-evaluation results from 40 undergraduate business school students were subjected to comparison analysis using an effect size described by Cohen's d-values. Using the effect size in the analysis helps to easily identify the areas or the specific items where the benchmarked university is doing well compared to others, as well as to find out the areas or items that could be subjected for improvement. According to the results, the benchmarked institution scored higher mean values in 95% of statements than all the other cases conducted with the instrument at public universities.

Keywords: Student engagement · Commitment · Expert system · Private academic institution

1 Introduction/Student Engagement and Retention

Student engagement describes the time and effort students dedicate to activities that are related to the desired outcomes of the educational institutions, and on what these institutions do to encourage students to participate in these activities [1]. Student engagement is often considered the best predictor of student learning and development [2, 3]. According to Harper and Quaye [4], engagement is not just involvement or participation; it also necessitates feelings and sense-making as well as being active. The majority of the research uses the definition of student engagement proposed by Astin, who defined student engagement as "the amount of physical and psychological energy that the student devotes to the academic experience" [5]. Student engagement is also defined as "the

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time and effort that students devote to educational activities, which are linked to desired outcomes" [6]. According to Kuh [1], a conclusion from most of the student engagement studies is that higher levels of engagement relate to higher academic performance, lower attrition, and higher retention rates.

Motivation is a complicated and complex issue that combines several specific behavioral factors such as needs, desires, efforts, and expectations. Students can be motivated but not actively engaged in a task. Thus motivation is necessary, but not enough for engagement [7]. Furthermore, motivation is a personal condition that encourages individuals to plan, implement, and desire certain activities to achieve a previously set goal. Motivation involves making the inputs that are necessary for changing the work, attitudes, and behavior [8].

Research suggests that an understanding of student engagement can help educators to prevent harmful outcomes and promote positive ones for at-risk students [9]. Therefore, it is important to measure and benchmark these factors affecting the student's engagement, so that the development activities and efforts can be directed of most beneficial areas. The objective of this paper was to analyze student engagement and motivation in a group of undergraduate students attending a private business school, in comparison to students attending public universities.

2 Student Engagement in Private Academic Institutions

Tinto [10] argues that students are more likely to stay and graduate when the institute, (1) expects them to succeed, (2) provides academic, social and personal support, (3) gives feedback regularly on their performance, (4) regards them as significant members of the institution (e.g., frequent and high-quality interaction with the academics, the staff, and other students), and most importantly (5) fosters learning. However, there might be differences in the priorities between public and private institutes of higher education. Private institutions have different operation principles, management practices, strategies and standards from the public (government) institutions. In private institutions, the students pay higher tuition fees and have expectations that could differ from what students expect in state institutions primarily in operations, support, administration management, infrastructure, and to an extent in the teaching quality, career development, student life, activities, etc. Many private academic institutions can be considered highly multicultural therefore the student engagement and commitment need to be approached from a cultural dimension as well, in both studying and learning. This cultural diversification extends also to the financial background of the students, where many might have secured professional careers while others might enter directly into their family business. Such students expect teaching and learning to be more practical, interactive, enjoyable, and less research-driven, more case driven and hands-on. This, on the other hand, can be a challenge for the academics who follow traditional academic teaching and research practices not quite aligned with the student's expectations and interests. Such cases, and not only, impact heavily the degree of student engagement and commitment and become quite significant issues and concerns for the development of the strategic management and leadership on the institution's operations.

3 Research Instrument

The research instrument used in this case study utilizes a generic, Internet-based application environment called Evolute. The Evolute system contains several self-assessment applications for various management related objects. The expert system-based application utilizes Fuzzy Logic in its generic analyses [11–13]. The instruments are ontology-based, and they are used to acquire perception and collective understanding of different organizational resources.

Table 1. Examples of Helix Academic features

Area	Feature	Description
		The extent that/how the students:
Motivation	Goal commitment (personal goals)	are committed to the goal of obtaining a degree and take responsibility for their studies
	Social integration (relatedness)	assess how participation and integration to a social group relates to their studies
Learning environment	Responsive environment	feel the study environment is responsive to promoting effective learning
	Learning support	feel their university is providing the support the needs for their studies
Institutional attachment	Commitment to the institution	feel loyalty to their specific university and their intent to graduate from it
	Emotional attachment	feel emotional attachment and connection to their specific university
Satisfaction	Utility	recognize the future value, usability, and utility of their studies and their results
External environment	External commitments	feel a personal bond, external to the study environment (family, community, etc.)

The instrument used in this study is based on well-known models of student persistence and retention. The main models used in the creation of the framework for the ontology and the statements for the instrument application was Tinto's Student Integration Model [14, 15] and Bean's Student Attrition Model [16, 17]. The instrument was developed using ontological modeling. Ontologies are formal representations of different concepts within a domain and their relationships. They are used to reason the

properties of a domain and may be used to define the domain. Gruber [18] defined an ontology as a "formal, explicit specification of a shared conceptualization". An ontology provides a shared vocabulary that can be used to model a domain that is, the type of objects and/or concepts that exist, and their properties and relations [19]. In the research instrument, the ontology consists of a classification of qualitative knowledge related to factors affecting students' engagement and motivation toward their institute of higher education and studies. The instrument contains 147 unique statements describing the features (n = 19) from multiple viewpoints. Table 1 present's example of features of the ontology-based application.

After the data collection using self-evaluated statements, the system computes and visualizes the meaning of the knowledge input collected from the respondents. Such a fuzzy logic-based system reminds an expert's task of evaluating and reasoning based on linguistic information.

4 Research Design and Analysis

In this research, we compared the self-evaluation results obtained using the previously described application from a private business school to the results of public universities. The case study was carried out at the HULT International Business School, in London, UK. 110 students who attended a course on Creating Problem Solving in two semesters were asked to participate in the research. In the end, 40 undergraduate students (36.4% of the participants) completed the research instrument. The mean age of the respondents was 21 years of age. Sixty-five (65%) percent of the respondents were male, and 35% female. In all, the respondents had 24 different nationalities. Overall, we have studied student engagement in 14 different universities with over 1100 students over the past 5 years. With the current improved version (v.2.0) of the instrument, we have had over 400 evaluation results. In this research, the business school students were compared to overall research data gathered from public universities with the instrument (n = 353).

The comparison of the groups was made using an effect size described by Cohen's d-values. Using the effect size in the analysis helps to easily identify the areas or the specific items where the benchmarked university is doing well compared to others, as well as to find out the areas or items for improvement. The effect size tells the relative magnitude of the difference between the two groups. It indicates the relative importance of the difference in scores between a treatment and a comparison group in an easy to understand way. By using the effect size, it was also possible to compare the obtained values to known benchmark values [20]. By using this method we can compare their differences based on respondents' evaluations. In the analysis, HULT was regarded as the treatment group and the combination of the other institutions (public universities) as the comparison (control) group. This way if the results are positive, HULT got higher scores. Effect sizes can also be negative if the treatment group performs on a lower level than the control group. However, the negative sign can also be an indication of scale direction instead of a perceived lack of performance. By using the effect size, it is possible to compare the difference to known benchmark values established by Cohen [20]. Cohen [20] describes d-values of 0.20 as small, 0.50 as medium (moderate), and 0.80 as large. Cohen states that a moderate effect size is large enough to be "visible to the naked eye".

The calculation of Cohen's d is straightforward. It can be calculated by dividing the difference between the two group means by their pooled standard deviation. By using effect size, items that have practical significance can be identified quickly which helps in the interpretation of the results.

Table 2. Statements and d-values distinguishing HULT

Statement	d-value
I am committed to achieving my study related goals	1.05
Sometimes I think it is not important for me to get a new degree (R)	0.91
I feel competent regarding the courses I am taking	0.82
My teachers and professors are accessible and give me support and help when I need it	0.81
I have access to study counseling I need	0.80
Provided materials and informational resources support the effective functioning	0.75
The courses and their activities are very interesting and rewarding	0.72
Teaching styles and environment promote creativity and innovation	0.70
I feel no obligation to remain and study with this particular university until I graduate (R)	0.70
My university provides me the things I am/was looking for	0.69
Teaching methods in this university are innovative	0.68
Performing on individual courses motivates me to continue my studies and to obtain the degree	0.67
I feel unsure about my abilities to pass the tests I need to take (R)	0.67
Students can challenge or appeal to decisions concerning them	0.67
The educators support my autonomy	0.67
I get full credit and recognition for the work I do	0.65
The style of teaching keeps me interested	0.63
My goal is to complete all the courses needed to obtain this degree	0.63
The educators regard me as a valued individual	0.63
Lack of alternative places to study keeps me in this university (R)	0.63
Teachers/professors motivate the students to learn and reach their goals	0.62
The educators are good at communicating with the students	0.61
It was my personal choice to study in this degree programme	0.60
My studies have a negative effect on my personal or family life e.g. financial or time pressures	−0.48

5 Results

According to the results, the benchmarked institution scored higher mean values in 95 percent of statements than the mean results of all the cases conducted with the instrument. Five of the statements scored higher than the d-value of 0.8, which Cohen describes a large effect size. Forty of the statements scored between 0.5 and 0.8, which according to Cohen, can be viewed as a moderate magnitude of difference between the groups. Table 2 presents all the statements where the d-value was higher than 0.6. The cutoff value of 0.6 was chosen to see the statements that have a relatively high effect size. Also, the only statement where HULT scored moderately high negative value is presented.

These results indicated that the assessed private university scored better in the evaluation than the other public universities assessed. For example, the value $d = 0.5$ means that the assessed HULT students scored 50% a standard deviation more than all the assessed students from the public universities.

6 Discussion

The main goal of the assessment presented in this paper was to find out if there were differences between private and public universities regarding the students' self-reported engagement and motivation. The analysis was done on the statement level to see the specific item where the major differences existed. This type of analysis can be used to "benchmark" the institution and to compare it to others. Benchmarking also provides an interesting reference point for implementing and managing change. Comparisons to other groups and subsequent analysis can uncover good and useful practices utilized by other institutions. This methodology with its methods to give university management new insight and information that can help them in their leadership and planning activities. By using the information gathered directly from the students, the management is more inclined to make effective developments plans because they can be based on such bottom-up information. These activities can, for example, help to advance the retention and satisfaction of the students. We have shown with our research that the respondents feel this way much more highly than the long-term average from multiple cases in different conventional universities. The test results seem to support the belief that students feel comfortable and that their university is interested in their motivation and learning. Based on the results, the students feel their private university invests effectively in their engagement compared to the results from the reference universities.

References

1. Kuh, G.D.: What student affairs professionals need to know about student engagement. J. Coll. Student Dev. **50**(6), 683–706 (2009)
2. Burch, G.F., Heller, N.A., Burch, J.J., Freed, R., Steed, S.A.: Student engagement: developing a conceptual framework and survey instrument. J. Educ. Bus. **90**(4), 224–229 (2015)
3. Schaufeli, W.B., Martínez, I.M., Pinto, A.M., Salanova, M., Barker, A.B.: Burnout and engagement in university students a cross-national study. J. Cross Cult. Psychol. **33**(5), 464–481 (2002)

4. Harper, S.R., Quaye, S.J.: Beyond sameness, with engagement and outcomes for all. In: Harper, S.R., Quaye, S.J. (eds.) Student Engagement in Higher Education, pp. 1–15. Routledge, New York, London (2009)
5. Astin, A.: Student involvement: a developmental theory for higher education. J. Coll. Student Pers. **25**(4), 297–308 (1984)
6. Kuh, G.D.: Assessing what really matters to student learning inside the national survey of student engagement. Change Mag. High. Learn. **33**(3), 10–17 (2001)
7. Appleton, J.J., Christenson, S.L., Kim, D., Reschly, A.L.: Measuring cognitive and psychological engagement: validation of the student engagement instrument. J. Sch. Psychol. **44**(5), 427–445 (2006)
8. Stoeva, P., Pitas, J.: Military students motivation: comparative analysis. In: Economics and Management, pp. 40–48. University Of Defence/Czech Republic, Brno (2018)
9. Hart, S.R., Stewart, K., Jimerson, S.R.: The student engagement in schools questionnaire (SESQ) and the Teacher engagement report form-new (TERF-N): examining the preliminary evidence. Contemp. Sch. Psychol. ERIC. **15**, 67–79 (2011)
10. Tinto, V.: Promoting student retention through classroom practice. Enhancing student retention: using international policy and practice, an international conference sponsored by the European access network and the institute for access studies at Staffordshire University, Amsterdam, pp. 5–7 (2003)
11. Kantola, J.: Ontology-based resource management. Hum. Factors Ergon. Manuf. Serv. Ind. **19**(6), 515–527 (2009)
12. Kantola, J.: Organizational Resource Management: Theories, Methodologies, and Applications. CRC Press, Boca Raton (2015)
13. Kantola, J., Karwowski, W., Vanharanta, H.: Managing managerial mosaic: the evolute methodology. In: Electronic Globalized Business and Sustainable Development Through IT Management: Strategies and Perspectives, pp. 77–89. (2011)
14. Tinto, V.: Dropout from higher education: A theoretical synthesis of recent research. Rev. Educ. Res. **45**, 89–125 (1975)
15. Tinto, V.: Leaving College: Rethinking the Causes and Cures of Student Attrition. University of Chicago Press, Chicago (1987)
16. Bean, J.P.: Dropouts and Turnover: The Synthesis and Test of a Causal Model of Student Attrition. ERIC (1979)
17. Bean, J.P.: Student attrition, intentions, and confidence: interaction effects in a path model. Res. High. Educ. **17**, 291–320 (1982)
18. Gruber, T.R.: A translation approach to portable ontology specifications. Knowl. Acquisition **5**(2), 199–220 (1993)
19. Arvidsson, F., Flycht-Eriksson, A.: Ontologies I (2008). http://www.ida.liuse/janma/SemWeb/Slides/ontologies1.pdf. Accessed 9 Jan 2014
20. Cohen, J.: Statistical power analysis for the behavioral sciences. Erlbaum, Hillsdale (1988)

International University Leadership Development

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Abstract. Looking into the importance and relevance of leaders in international higher education institutions, the author starts his journey by reviewing literature on global, effective and successful leadership to anchor his own understanding of international leadership. This paper is positioned as a design research paper on the concept of University International Leadership. By conducting targeted expert interviews, the author takes into account in his model the Leader Personal Dynamics (Attitude, Behavior, Competencies, Skills, Knowledge) and Glocal University Dynamics where International University Leaders operate. The Glocal concept fits the strategy of a University of Applied Sciences as Arnhem Business School, the Netherlands, to stay globally relevant but also keep its local identity. University international leaders need to create a good understanding of where it adds value to be global and where it is better to be local developing the right mindset and skillset required to succeed in this complex international environment.

Keywords: International University Leadership · Glocal · University dynamics · International leaders · Glocal adaptative leadership

1 Introduction

Although there is much written about the concept of Global Leadership, the author is positioning this paper as a design research paper on the concept of University International Leadership. In a dynamic international environment such as a university where the pressure to perform and compete globally is obvious, the role of the leader has changed significantly. Looking into the importance and relevance of leaders in international higher education institutions, the author starts his journey by developing a literature review framework on the various definitions of global leadership to anchor his own definition of International Leadership. By conducting targeted expert interviews with the Arnhem Business School (ABS), the Netherlands management, the author takes into account Personal dynamics (Attitude, Behavior, Competencies, Skills, Knowledge) and Glocal University Dynamics (Students, Academics, Researchers, Culture, International Partnerships, International Accreditations, Funding) to define International University Leadership as adaptive, strategic, transformative and Glocal in nature.

The university international leaders need to take into account organizational structures and processes in a context involving multiple cross-boundary stakeholders, to

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encounter multiple cultures and cross-boundary authority under conditions of international complexity. All the stakeholders involved must work together in an international setting that brings up challenges, integrations and connections that need to be deciphered by university leaders to better lead the university towards global goals.

To truly embrace their globalization and internationalization strategies, universities need to dedicate better resources to developing international leaders throughout their careers, as development of global competencies and capabilities among leaders is paramount to organizational effectiveness and competitive advantage. Therefore, university international leaders need to create a good understanding of where it adds value to be global and where it is better to be local. The "Glocal" concept fits the strategy of a university to stay relevant globally but also keep its local identity. Leading internationally is a level up for universities in complexity and leaders need to develop the mindset and skillset required to succeed in this complex environment.

Proposing a new model on University International Leadership is not easy, therefore validations at other universities as case studies in the future are necessary. The three folded impact of this research is obvious as all the stakeholders involved will positively benefit as international students, university international leaders, staff members are interconnected in a dynamic international environment.

2 Literature Review on Global and International Leadership

A large variety of boundaries, not just linguistic and national, is connected through international and global leadership. In order to work across a wide range of boundaries are in the workplace and beyond it. These boundaries may influence the leadership interaction and multiplex and they include age, professional group, religious belief, cultural traditions, and language and so on. This is due to the fact that various evaluative expectations and assessment may appear since cultural vision and practices are proper to any cultural group, no matter its size. Additionally, each person may be distinguished by her or his own personality, personal history, and sense of identity etc. As a global leader it is extremely important to be able to think and act out of the box in order to be effective. By doing this, global leaders may overcome those situations, challenges and cultural settings that are outside of their known settings.

Personal challenges that global leaders have to overcome have been discussed in literature [1]. In order to get knowledge to work in diverse cultures, leaders have to enrich their international experience and to get through emotional dimensions of different mindsets. On the other hand, global international leaders should avoid losing out their promotions when returning from international experience. Consequently, global leaders should pay attention to keep a supportive network at their local organization [1].

Besides personal challenges, global managers and leaders have to face many external challenges every day. Such external challenges are not easily handled and controlled by individual leaders. Issues related with external challenges may appear in those situations when the world is more interconnected and it is based on a large range of sources that may be driven by people having different perspectives, different cultures and living in different countries [2]. Global leaders must overcome also transformative challenges. The relationship between transformational leadership and psychological well-being has been

analyzed by Kellowaya et al. (2012) [3]. According to their research employee psychological well-being is negatively affected by reducing trust in the leader by management-by-exception and laissez-faire behaviors [3]. On the other hand, according to Love and Cugnon (2009) using diverse mechanism to improve followers' morale, performance and motivation have to be the primary transformative mission for global leaders. By this kind of mechanism passion can be sustained [4]. Only by leading from their mind and heart may be sufficient for international leaders to find solutions for the business challenges ahead.

International leaders need to develop long term strategies and implement strategic decisions that will lead to sustainable success on the long term [5]. However, strategic decisions are met with much internal resistance, because people tie their academic passions and concerns to any proposal or decision considered, making university leadership challenging and frustrating [6]. As a response to internal resistance, general management at one extreme can react as tyrants, dictating their decisions. On the other extreme, leaders can act as figureheads who do not make any decision or take any responsibility [6]. Therefore Lynch (2015) suggest that strategic leadership is needed to shape organizational decisions so value can be created [7].

In order to create a high level of performance in organizations that both recognizing and understanding the values that generate conflict and using the ability to solve the challenges generated by cultural differences and group differences are necessary [1]. A satisfying workplace environment is necessary for a high performance, effective organization to achieve superior results. This satisfying workplace should be accompanied by a clear strategy, shared vision and cohesiveness. Participatory decision-making is encouraged by global leaders as facilitators.

Crowley (2011) states that for the employees it is highly significant nowadays to notice that both inner feelings and work results are appreciated by global leaders in order to reach successfully the desired achievement and performance [8]. Due to this, global leaders should value, develop, respect and care for their employees. Consequently, that culture where employees' personal passions and purpose can thrive in association with professional values and skills. Curiosity and imagination are necessary to deliver solutions and passion; subordinates consider these kinds of leaders as inspirational and transformational [4]. A worthy consideration is represented by the position related to transformational leadership and leaders' primary transformative mission.

In the transactional approach, leaders enter into an exchange relationship with their followers using rewards in exchange for their support. If the follower shows effort and performance, the leader will give personal and material rewards. In the opposing approach, the transformational approach, leaders are open to the needs and interests of subordinates, and on the other hand, create discipline within an organization [6]. Northouse (2013) concludes that transformational and transactional leadership style are not mutually exclusive but are interconnected with each other most leaders apply the characteristics of both transformational and transactional leadership depending on the situation at hand [9]. Generally speaking, the transactional leadership is preferred for short-term objectives, and transformational leadership is better in supporting long term objectives, especially when the impact on the organizations is huge [10]. The question is short vs long-term objectives, having in mind the complex dynamics of an university.

According to Gurchiek (2011), it is more important to value global perspective instead of cross-cultural perspectives of teams [11]. Cultural diversity and the employees who are geographically widespread may become a unified team in global perspectives. A global perspective means that both global identity and local and national identities are held together in parallel. Thus, it is highly important that global leaders consider themselves as part of a global team and due to this it is necessary that they have superior degrees of global identity. A cultural diversity, cultural intelligence, global leadership behaviors and a global identity are necessary for global leaders in order to adapt to a global work culture and also to be able to lead a global team [11].

Wang, Zhang and Waldman (2012) bring forward that strategic leadership can help organizations to enhance their value creation, so a powerful competitive advantage is created [12]. To sustain a competitive advantage, successful and effective leaders must be able to motivate their followers and take up the responsibility to develop the skills and abilities of individual employees on the long term, so an organization learns to adapt to developments in the environment [6].

Surely it is not about how good leadership should be when it is discussed as a leadership challenge. Actually, it is more about the process of growing global minds until reaching a higher level and due to this it is a development challenge. Leaders have become beginners in their own global development while they have reached the expert level regarding the "what" of global leadership [13]. Leaders of international universities should develop both internal and external relationships systems in order to accomplish several objectives such as the developing of a leadership vision, capitalizing the information resources, associating an implementation plan and also creating a collaborative corporate culture. In order to respond to all those different value and practices into a positive and effective way, leaders should have the ability to listen to the opinions of others and to new ideas [14]. Thus, be adaptive, flexible and cultural aware.

Several studies also have attempted to conceptualize the idea of what makes a successful leader. As shown by Hussain and Hassan (2015), history gives all kinds of examples of leaders who shaped the course of an event or changed history [15]. Lynch (2015) defines successful leadership as the art to influence people, so they contribute enthusiastically to the achievement of an organization's purpose [7]. In this context one of the strategic activities of leaders is to use all their knowledge, energy and enthusiasm to lead their subordinates to an effective and efficient organization [7]. A vital component to achieve the organizational purpose is the development of a mission, vision and the objectives of an organization and to safeguard that these objectives are successfully implemented [7]. In this respect Morrill (2010) concludes that leadership at universities is a form of bureaucratic decision making, where decision making and the implementation of decisions filters through several layers of protocols and faculty and institutional committees [6].

Investigating the literature as above mentioned, it created an understanding that successful international leadership is a combination of various internal and external factors associated with adaptability, transformation, culture awareness, global development, international dynamic settings, effectiveness, skills development and strategic advantage.

3 International University Leadership Model

Based on the targeted expert interviews with the Dean and the Management Team at Arnhem Business School, the Netherlands, working in a global environment such as an international university, international university leaders must overcome different challenges:

1. Adjusting personal habits, attitude and behavior where competencies, skills, and knowledge need to be uplifted. Any leader is identified by their cultural habits, attitude and assumptions. It is highly important that international university leaders are aware of these influences and dynamics as part of their own thinking and are able to go beyond these impacts. As international leaders all actions and choices should not be limited only to their culture. International and global leaders' behaviors should be adapted accordingly to the situations and people based on their skills to understand and lead involved stakeholders and situations.
2. Building shared aims and introducing shared work. Even in situations with cultural differences leaders in international universities must identify the best methods to find common points and perspectives. Other cultural vision should be understood and appreciated by international university leaders and at the same time they should be capable to align the entire team around the university mission, vision and goals.
3. Dealing with cultural disputes. Since international leaders have to manage simultaneous groups having multiple cultures, they must know how to deal with different incidents and situations that may be seen as conflicts. Even if in some situations the cultural conflicts are obvious, in most of the situations the cultural differences are very subtle and easy to be missed by leaders.
4. Guiding the local and corporate relationships. Very often between regional or local offices and international stakeholders may appear different tensions that have to be managed by global leaders. This is a significant challenge for international leaders since they must drive decisions according to local need, regulations, customs and practices. Moreover, international university leaders should find the methods to infuse corporate-level expectations at the local level and to manage the constant duality between striving to be both international and local in nature. The Glocal dynamics of universities are thus inherent and obvious.
5. Overcome barriers and communicate. Since very often global leaders are operating from with international stakeholders, communication is essential, and it is very complex. Communication may be considered as a great challenge in any setting since different barriers such as geographic distance, language and cultural behaviors should be outclassed by international leaders in order to be effective.
6. Comprehending and operating external forces. Various factors are influencing the work of the international university leaders, such as governmental, historical, legal and economic factors. Consequently, learning how to deal with these factors is a requirement for leaders that are having business globally. Since these external factors may very often influence how the university operate, it is very important for international university leaders to admit that they can't fully control these external

forces that may influence their decisions. Funding procedures, international accreditations and international partnerships are posing challenges and international university leaders need to embrace a mix of leadership styles: adaptive, strategic and glocal in nature.

Following the outcomes of the interviews and thorough literature research, the author presents the International University Leadership Model as response and learning point for the future to other universities that struggle with challenges such as earlier mentioned (Fig. 1):

Fig. 1. International University Leadership Model

International university leaders should be able to account for the cultural and behavior differences in other cultures in order to be able to motivate and lead people to complete the work of the university into an effective way. The mutual goals of the university should be accomplished, and international university leaders play a significant role in understanding both personal and external challenges, but also having knowledge and skills in conflict management. Political and cultural boundaries are eliminated with the help of truly global leaders. These international leaders are acting as connectors of resources and bridge builders. Individuals and various stakeholders are connected across boundaries through the help of these international leaders who are using an international global mindset.

In those situations when universal principles of effective, strategic leadership are mixed with a multicultural mindset we speak about a successful leader. Despite the fact that very often international leaders have to respond to various situations that are very different from what they are familiarized with, only by showing adaptability and flexibility to respond in a constructive manner international leader can succeed in a competitive international university. Therefore, the transformative, still glocal in nature international university leadership is obvious and impact is evident. Such a successful leader is always able to create a positive impact in the organization since he or she is considered as a part of the international team.

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References

1. Nirenberg, J.: Global Leadership. Capstone Publishing, Oxford (2002)
2. Friedman, T.L.: The World is Flat: A Brief History of the Twenty-First Century. Picador/Farrar, Strauss and Giroux, New York (2007)
3. Kellowaya, E.K., Turnerb, N., Barling, J., Loughlina, C.: Transformational leadership and employee psychological well-being: the mediating role of employee trust in leadership. Work Stress **26**(1), 39–55 (2012)
4. Love, A., Cugnon, M.: The Purpose Linked Organization. McGraw Hill, New York (2009)
5. Hill, C.W.L., Jones, G.R., Schilling, M.A.: Strategic Management: Theory: An Integrated Approach. Cengage Learning (2014). https://books.google.nl/books?id=Qy8aCgAAQBAJ
6. Morrill, R.L.: Strategic Leadership: Integrating Strategy and Leadership in Colleges and Universities. Rowman & Littlefield Publishers (2010). https://books.google.nl/books?id=36Bw6AiRniwC
7. Lynch, R.: Strategic Management, 7th edn. Pearson, Harlow (2015)
8. Crowley, M.C.: Lead from the Heart: Transformational Leadership for the 21st Century, 1st edn. Balboa Press, Bloomington (2011)
9. Northouse, P.G.: Leadership: Theory and Practice, 6th edn. SAGE, Thousand Oaks (2013)
10. Asrar-Ul-Haq, M., Anwar, S.: The many faces of leadership: proposing research agenda through a review of literature. Future Bus. J. **4**(2), 179–188 (2018)
11. Gurchiek, K.: Look for global, rather than cross-cultural, perspectives. HR Mag. 89 (2011)
12. Hurd, M., Nybert, L.: The Value Factor, 1st edn. Bloomberg Press, Princeton (2004)
13. House, R.J., Hanges, P.J., Mansour, J., Dorfman, P., Gupta, V.: Culture, Leadership, and Organizations. The GLOBE Study of 62 Societies. Sage Publications, Thousand Oaks (2004)
14. Hussain, M., Hassan, H.: Military leadership and implications for business leaders in the light of alternative theories. Pak. J. Sci. **67**(1), 94–101 (2015)
15. Wang, H., Waldman, D.A., Zhang, H.: Strategic leadership across cultures: current findings and future research directions. J. World Bus. **47**(4), 571–580 (2012)

Development of Psychological Readiness of the High School Students to Enter Higher Educational Institutions

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Abstract. The research of the psychological readiness development of high school pupils to enter higher education institutions and to pass an external independent assessment based on the implementation of the author's program "Successful entrant" has been revealed in the article. The analysis of psychological literature on this issue has been made. The problem of professional self-determination of high school pupils, their psychological readiness for admission and its structure represented by emotional, motivational and volitional components have been considered. With the help of empirical research, the increase of levels of identified components and psychological readiness in general have been found out.

Keywords: Psychological readiness · Admission to HEI · Entrant · Emotional component · Motivational component · Vocational orientation

1 Introduction

The urgency of the research topic is connected with the fact at the present stage of the education system reforming in order to solve a number of practical problems, it is important to answer the two interrelated questions: first, how successfully a modern secondary school fulfills its developing function and, second, the extent to which high school students are ready to enter and study in the higher education institutions in a personal plan.

The problem of psychological readiness of the high school students to university entrance is closely related to the professional self-determination of the personality, which is considered and highlighted on the basis of theoretical positions of K. Abulkhanova-Slavska, I. Bulakh, D. Leontiev, S. Maksymenko and other scientists on the psychological future of the personality projecting oneself into the distant and near temporal future and zones of immediate development as a special and real sociopsychological space for predicting the formation of a person in childhood. Besides, in the psychological science, there are a number of approaches to highlighting in the structure of senior students' readiness for professional self-determination of individual components and indicators: in the study of I. Bushai the cognitive, emotional-evaluative and behavioral components are

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identified; V. Semychenko's structural construction of personality readiness for professional activity is represented by the operational, functional and personal readiness; in the "one's self-concept" developed by R. Burns, the self-esteem and professional aspirations characterize a person's self-consciousness, his motivational and cognitive component, which represent the dynamic, evaluative and emotional nature of the person's ideas about himself and induce the individual to certain behavior [1, 2, 4, 5].

But in the psychological and pedagogical literature the issues of social and psychological readiness to university studies, which is developed through the implementation of specially designed development programs, have not been sufficiently studied. The objective of this article is to investigate the development of students' psychological readiness to enter the higher education institutions, which is represented by emotional, motivational and volitional components.

2 Methodology

To achieve the set goal, the following methods have been used during the diagnostic procedure: questionnaire "Self-assessment of psychological readiness for independent assessment" (modification of the methodology of Yu. Chybysova), which allows to assess the readiness for independent assessment by high school pupils; the questionnaire "Motivation for success" of T. Ehlers, which is aimed to study the motivation for success; the questionnaire "The ability to self-management" of N. Peysakhov, which allows to learn about the ability to manage themselves in different situations; "Test to determine the stress resistance of personality" of N. Kirshov, which allows to reveal features of neuropsychic stability; methods of mathematical-statistical data processing: finding of percent values. During the formation experiment, the author's program "Successful entrant" has been used. It has been implemented at Pavlo Tychyna Uman State Pedagogical University during 2018–2019, where 120 high school pupils have been involved. Program volume is 24 h (12 lessons).

3 Results

The current state of higher education is characterized by significant heterogeneity in the level of applicants training, caused by psychological, social, demographic and other changes that are taking place in society. These phenomena have a negative impact on the organization and management of the educational process in the higher education institutions, creating a set of problems related to the quality of education. The situation is greatly exacerbated by the desire to get higher education by different social groups and by the rapid changes in the society itself.

The existing system of assessments of applicants' readiness for education under the chosen specialty allows to determine only their knowledge and skills at the time of entering the higher education institutions (mainly on the basis of EIT). It does not sufficiently assess the individual components of the applicant, such as motivation to master a particular specialty, his intellectual and creative abilities, features of cognitive processes etc. [6]. According to V. Gladkyhk and M. Yemets readiness is formed under

the influence of orientation, which, in turn, creates a kind of subject "setting" for future activity [3].

In this regard, readiness to enter the higher education institutions can be seen as a complex integrative quality of personality, representing the dynamic state of the individual, possessing theoretical and psychological readiness for higher education, formed by a professional orientation and ability to adapt to new learning environment. Psychological readiness is a mental state characterized by the mobilization of the subject's resources for the prompt or long-term accomplishment of a specific activity or task.

The dynamic structure of the state of psychological readiness to enter the higher education institutions is a holistic formation that includes a number of components, the main of which are: motivational components – the need to successfully accomplish the task, the interest in the activity, the desire to succeed; cognitive components – understanding of responsibilities, work task, evaluation of its importance for achieving the end results of the activity and for oneself (in terms of prestige, status); emotional components – a sense of professional and social responsibility, confidence in success; willful components – self-management and mobilization of forces, focus on the task, distraction from interfering influences, overcoming doubts, fear; communicative components – the willingness and ability to easily establish and maintain positive contacts in communication and interaction with others.

In our study we used the structure of psychological readiness: conative, motivational and emotional components. The conative component is self-control, self-possession, the ability to control one's emotions. The motivational component is the need to succeed. The emotional component includes stress resistance, the ability to manage one's behavior and self-confidence.

The students of the 11th forms of Uman secondary schools took part in the research. The total number of students involved in the experiment is 120. There were two groups: the control group (80 people) and the experimental group (40 people). The participants ranged in age from 17 to 18 years, a gender aspect wasn't taken into consideration.

We conducted a pilot study using the author's questionnaire, which revealed the importance of psychological training for students. The students are interested in the successful pass of the EIT, in obtaining high results, and this, in their opinion, will be promoted not only by subject knowledge, but also by some personal characteristics (self-confidence, ability to manage their emotions, behavior, cope with anxiety, fear, and excitement). On the basis of the obtained data, we came to the conclusion that students have to identify the level of formation of the psychological readiness components for EIT pass.

For the achievement of the set tasks we performed the following psycho-diagnostic methods: the questionnaire "Self-assessment of psychological readiness for EIT" (modification of the method of M. Yu. Chybysova), the questionnaire "Motivation for success" of T. Ehlers, the questionnaire "The ability to self-government" of N.M. Peisakhov, "Test for the stress resistance determination" of N.V. Kirshov.

At the ascertaining stage of the experiment we conducted a study of the level of the psychological readiness development of graduates to pass the EIT through its structural components. According to the empirical study results, the most developed component is conative (27% – high level of formation; 33% – average level of formation; 40% – low

level of formation), and the following components were the least developed: emotional (8% – high level of formation; 42% – average, 50% – low) motivational (17% – high level of formation; 48% – average; 35% – low). According to the empirical study, a high level of the psychological readiness development of graduates to the EIT had 17% of graduates, the average level – 41% of high school students, low – 42% of the experiment participants. Thus, the results of the ascertaining stage of the study showed that 78% of high school students need psychological support to develop psychological readiness for passing the EIT.

The purpose of the formative stage is the approbation of the program "Successful Applicant Studios" at Pavlo Tychyna Uman State Pedagogical University, which aims at improving the level of psychological competence for graduates of the EIT, ensuring professional orientation and creating favorable conditions for comprehensive personal development of high school students. The program includes 12 sessions: "Acquaintance. What is Psychology: Myths and Reality", "Learning to Manage Emotions", "Conflicts and Ways to Overcome It", "Regulation of Emotional Condition", "Positive Thinking. Good Mood Components", "Me and my Self-Esteem", "Positive Motivation Development", "How to Achieve a Goal or when Dreams Come True", "Time management", "Leadership Skills Development "I will succeed. I am a Leader!", "Visualization of your Dreams ("Collage of your Dreams"), "Motivational Training "Find your Way", "Diagnosis of Professional Tendencies and Interests". Classes are aimed at: promoting mental health; professional self-determination and self-realization of personality; understanding how to deal with conflicts properly; understanding how to control their emotions; learn to rationally allocate your time; acquire the skills to be successful; make a conscious choice about your future profession.

Let us consider the changes that occur in the formation of formal experiments regarding the components of psychological readiness according to the questionnaire "Self-assessment of psychological readiness for EIT".

As it can be seen from the Table 1, behavioral component most (procedural readiness) is the best formed by the high school students before and after the experiment, as EIT has been a prerequisite for admission to a higher education institution since 2008 and this procedure is clear and accessible to all.

Table 1. The results of self-assessment of psychological readiness for HEI (in%)

Levels		Low				Average				High			
		Before		After		Before		After		Before		After	
Components		CG	EG	CG	EG	CG	EG	CG	EG	CG	EG	CG	EG
Procedural readiness		5	–	–	–	35	30	40	25	60	70	60	75
Psychological readiness	Organization and control	20	20	10	10	40	30	30	20	40	50	50	70
	Anxiety	10	10	20	55	40	45	35	25	50	45	45	20

By the comparative analysis of the EG and CG psychological readiness indices during the forming experiment the dynamics towards the EG indices increase was revealed, which manifests itself in the ability to self-organization and control, as well as reducing anxiety. This indicates that psychological preparation is also very important for the students.

To study the motivational component, we conducted a "Motivation for Success" questionnaire by T. Ehlers.

According to the results of the conducted diagnostics to the forming experiment it should be said that in both EG and KG the average level of motivation for success (45% and 50%) is dominant, and in both groups the percentage of low motivation level (35%) is high. The conducted comparison of all the indices of levels of motivation for success allowed to draw a conclusion that the differences in the levels of motivation to the success of EG and CG before the experiment are insignificant (Table 2).

Table 2. The results of the study of high school students' motivation to success (in%)

Motivation level	Before		After	
	CG	EG	CG	EG
Low	35	35	35	15
Average	50	45	45	40
High	15	20	20	45

The analysis of the results of the forming stage showed that the indices in the EG significantly increased compared to CG, 45% of students seek to achieve something constructive, positive. The activity of their personality is based on the hope for success and the need for success. A person motivated for success aims for it and usually works hard to succeed.

Thus, the experience gained by EG students during the program is an important factor in the development and formation of motivation.

To study the conative component, we used the questionnaire "Ability to self-government" by N.M. Peisakhov.

The obtained results showed that changes in the number of students with different levels of self-government development are observed in the EG (Table 3). The decrease in the number of EG students, who are characterized by the "low" and "average" levels of development of the ability to self-government as well as the increase in the number of students who are characterized by the "high" level of development of this quality confirm the effectiveness of the developed program.

Based on the results obtained, we concluded that there are differences in the level of development among high school students of such units of the process of self-management activities as: 1) "analysis of contradictions", "planning" and "quality assessment criteria", 2) "forecasting", "planning" and "quality assessment criteria", 3) "target setting", "planning" and "quality assessment criteria", 4) "planning", "self-control" and

Table 3. The results of the study of the ability for self-management (in%)

Development levels	Before		After	
	CG	EG	CG	EG
Low	40	40	30	20
Average	30	35	40	35
High	30	25	30	45

"correction", 5) "quality assessment criteria", "decision making", "self-control" and "correction".

To study the emotional component, we conducted a questionnaire "Test for the determination of the stress resistance of the personality" by N.V. Kirshov.

Analyzing the results of the repeated diagnosis, significant changes can be seen in the results obtained before and after the programs in the EG. After the program, 25% of EG students have high levels of stress resistance (Table 4). This indicates that students have a stable harmonious state, always and everywhere, cope with stress, consider a strong shock to be a life lesson, are able to manifest their strengths and quickly restore their mental state. 55% of students have an average level of stress resistance, which indicates that the high school students have internal protection and they easily remove the nervous excitations, but not completely, they are characterized by the ability to relax in any environment. But only 20% of students have low levels of stress resistance, they are not able to make the right decision in the strong nervous excitement, thus it is necessary to change their lifestyle dramatically. The program developed by us confirms the necessity of conducting such form of work with the students.

Table 4. The results of the study of personality stress resistance (in%)

Stress resistance level	Before		After	
	CG	EG	CG	EG
Low	55	45	45	20
Average	40	45	45	55
High	5	10	10	25

In order to identify the impact of the implemented program, which is aimed at increasing the level of graduates' psychological competence for EIT, the significance of differences in indices of psychological readiness components was analyzed.

As it can be seen from the Table 5, the psychological readiness of students in the experimental group increased by 20% compared to 3% in the CG The data analysis proves the effectiveness of the implementation of the program "Successful Applicant Studios".

Table 5. Comparative results of the study of components before and after the molding stage (in%)

Components	Levels											
	High				Average				Low			
	CG		EG		CG		EG		CG		EG	
	Before	After	Before	After	Before	After	Before	After	Before	After	Before	After
Motivational	15	20	20	45	50	45	45	40	35	35	35	15
Conative	30	30	25	45	30	40	35	35	40	30	40	20
Emotional	5	10	10	25	40	45	45	55	55	45	45	20
Psychological readiness	17	20	18	38	40	43	42	43	43	37	40	19

4 Conclusions

As a result of the formation stage of the experiment, significant changes in the psychological readiness increase took place on the basis of the program implementation. Therefore, the psychological program is effective for the students of the 11th forms. In order the high school students to feel confident during EIT passing, they need not only bundle of knowledge, but also special psychological training. The program proved to be effective in increasing the level of motivation for success of the students, in the formation of stress resistance and skills of conscious self-regulation of their mental states, mastering methods of relieving psychological stress through relaxation exercises; self-government.

References

1. Bulakh, I.: Psykholohiia osobystisnoho zrostannia pidlitka: monohrafiia (Psychology of Adolescent Personal Growth: monograph). NPU named after M.P. Drahomanov, Kyiv (2003). (in Ukrainian)
2. Burns, R.: Razvytye Ya – kontseptsyy y vospytanye (Development of One's Self-Concepts and Education). Progress, Moscow (1986). (in Russian)
3. Gladkikh, V.G., Yemets, M.S.: Formyrovanye professyonalno pedahohycheskoi hotovnosty bakalavra tekhnolohycheskoho obrazovanyia kak nauchnaia problema (Formation of Professional Pedagogical Readiness of a Bachelor of Technology as a Scientific Problem). Vestnyk Orenburhskoho hosudarstvennoho unyversyteta – Bull. Orenburg State Univ. **2**(121), 133–139 (2011). (in Russian)
4. Leontiev, D.A., Shelobanova, E.V.: Professyonalnoe samoopredelenye kak postroenye obrazov vozmozhnoho budushcheho (Professional Self-determination as the Development of Possible Future Images). Voprosy psykholohyy – Psychol. Issues **1**, 57–65 (2001). (in Russian)
5. Maksymenko, S.D.: Rozvytok psykhiky v ontohenezi (Mental Evolution in Ontogeny), vol. 1–2. Vackler, Kyiv (2002). (in Ukrainian)
6. Melnychuk, S.K.: Psykholohichni osoblyvosti stanovlennia vydiv upevnenosti v sobi u yunatskomu vitsi (Psychological peculiarities of self-confidence types becoming in youth), Nauka i osvita – Sci. Educ. **9**, 42–47 (2017). (in Ukrainian)

International Entrepreneurship: "Glocal" Business Creation, Development and Sustainable Employability

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Abstract. This article proposes a new approach model that frames International Entrepreneurship in a "Glocal" context where co-creation is essential by providing stakeholders with knowledge, insights and skills in how they can create new business models, develop new and existing businesses towards an output of Sustainable Employability. The model functions as a conceptual model and as starting point for future international case studies. This new model can help bridge the gap between the knowledge co-creation triangle professional field, education and research while enabling an in-depth exploration of which transferable international entrepreneurial skills and behaviors need to be developed. Additionally, the way students adopt skills must be adapted and this can be achieved by a more symbiotic relationship between employers and universities. Examining the most desired skills by local employers, in various regions and countries, provides context and incentive to act on this insight, allowing universities and students to make informed decisions.

Keywords: International entrepreneurship · "Glocal" · Business creation and development · Sustainable employability · International entrepreneurial skills

1 Introduction

Knowledge exchange between universities and local business in collaborative contractual research partnerships is increasing more and more nowadays. These advances instigate new mindsets and skills for academic researchers and international students who should be able to translate their new academic and new business concepts into new start-ups or "Glocal" business developments. In addition to the traditional role of universities to deliver high-quality professionals and excellent scientific knowledge, society requires greater attention to the transfer and commercialization of knowledge with the aim to encourage new business development with regional impact [1].

Mansfield, R.S et al. suggested already in 1987 that one of the first steps towards competency-based education in the entrepreneurship field is the identification of relevant entrepreneurial competencies as they can predict business formation and success within and across cultures [2]. Also, other authors sustain that the identification of relevant

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entrepreneurial competencies should provide insight into the field of entrepreneurship, and such competencies might predict business formation and success within and across cultures [1].

In the present economic situation, having knowledge of an academic subject is no longer sufficient for a new graduate. Students are increasingly required to have skills and abilities which will increase their employability in a "glocal" environment [3]. To this disclosure, in this article the author explains how effective international entrepreneurship education prepares students to be responsible, enterprising individuals who become entrepreneurs or entrepreneurial thinkers and contribute to economic development and sustainable local communities.

The present article links the demand from education to train students for more internationally competent professionals to the demand from companies for employees who are culturally sensitive and have knowledge, attitude to skills that fit into an international context through a "glocal" perspective. This involves research into the connection between education and the professional field and the extent to which the developed competencies and skills in the professional field match the issues that local companies face when going international where new business schools' graduates can contribute significantly. The theme is urgent because the labor market, and therefore the regional labor market, is expected to be subject to fundamental changes from local to global in nature.

This article proposes a new approach model that frames International Entrepreneurship in a "Glocal" context where co-creation is essential by providing stake-holders with knowledge, insights and skills in how they can create new business models, develop new and existing businesses towards an output of Sustainable Employability. The model functions as a conceptual model and as starting point for future international case studies. This new model can help bridge the gap be-tween the knowledge co-creation triangle professional field, education and research while enabling an in-depth exploration of which transferable international entrepreneurial skills and behaviors need to be developed. Additionally, the way students adopt skills must be adapted and this can be achieved by a more symbiotic relationship between employers and universities. Examining the most desired skills by local employers, in various regions and countries, provides context and incentive to act on this insight, allowing universities and students to make in-formed decisions.

2 "Glocal" Business Creation, Development and Sustainable Employability

Unemployment under the just graduated students is being recognized as one of the problems that could grow into global proportions in the coming years causing social and economic problems for the societies. There is a clear and undisputed link between economic growth and international entrepreneurship which has been highlighted by various studies and facts as "entrepreneurship is based on activities that convert ideas into economic opportunities" [3].

According to the latest PWC report, Workforce of the future (2019), big businesses have been outflanked in a digital enabled world that's teeming with small entrepreneurial

companies [4]. Digital platforms match worker with employer, skills with demand, capital with innovator, and consumer with supplier. This allows entrepreneurs to reach far beyond their size in terms of influence and scale. Workers find flexibility, autonomy and fulfilment, working for organisations with a strong social and ethical record. This is the collective response to business fragmentation; the desire to do good, for the common good [4].

The skills needed for the future are not just about science and technology. Human skills like creativity, leadership and empathy are in demand [5]. Important for local entrepreneurs and SME's, higher education institutions and students is to identify the skills that are necessary and start to concentrate on how to build them – and how to use them alongside technology.

Based on the feedback received from the Han Lectorates and the startup companies in the region of Gelderland, Arnhem involved, it was concluded that first professional field needs to:

- Understand the skills they have in their workforce now and the gaps to the skills they will need in the future.
- Strengthen innovation, creativity, empathy and leadership capabilities in their business alongside critical technology skills.
- Make talent and capabilities management a matter of urgency – or risk losing the battle to harness technological breakthroughs and innovation in their sector.
- Build and nurture adaptability in their workforce by harnessing a flexible talent mix, new ways of working and learning, and radically different career paths.
- Redesign traditional 'one-size-fits-all' policies to deliver on new learning and development models, career paths, capability models and the redesign of jobs and compensation frameworks.
- Develop more circular and sustainable business models and revenue streams models.

Graduate management education is a means to candidates' ultimate goal – employability. According the Employability and Business School Graduates, Corporate Recruiters Survey (2019), there is a reasonable expectation that a graduate business credential will lead to the improved employment outcomes graduates seek, and to that end employability. Based on the critical applicant choices for a business school, it is important that business school practitioners in a variety of functional areas understand what employers are looking for in recruiting recent business school graduates about how they make their work decisions and how they judge business schools to prepare their graduates for success in a global and international setting [6].

Using a both a qualitative and a quantitative methodology is thus crucial on how to have all the stakeholders (students, entrepreneurs, researchers) working multidisciplinary where co-creation and added value is not only created, but also shared, disseminated in a sustainable, circular manner. The three folded impact and added value to the mentioned stakeholders, society and science is obvious and it is meant to contribute to a future-proof workforce for a flourishing economy in an international environment where top international talents stimulate the local economy, startups and SME's.

Through future-oriented applied research with the startups and SME's this model and article can shed more light on the possible effects of exploration of possibilities for

social innovation and international entrepreneurship that could be realized to support the transition process. The research can provide more insight into what exactly the difference is in the current versus the desired level of education, knowledge and entrepreneurial skills of the stakeholders involved (Fig. 1).

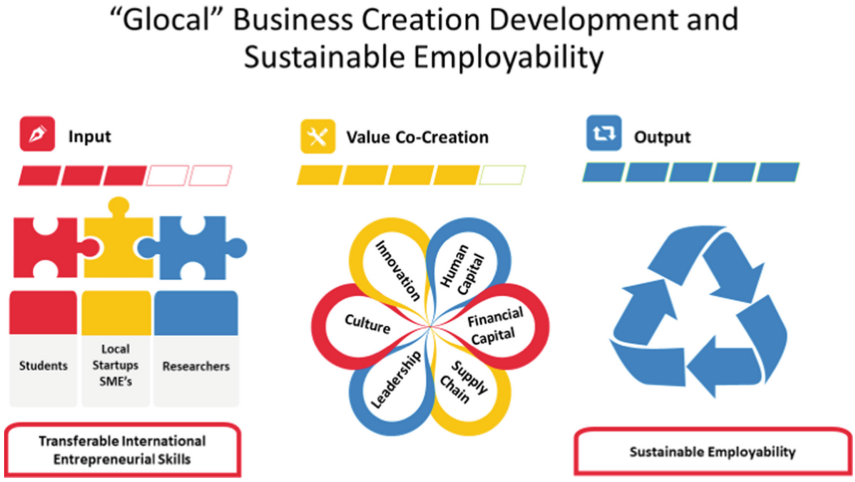

Fig. 1. "Glocal" Business Creation, Development and Sustainable Employability

Changing a company that mostly operates for a local market to an international market consisting of trade with other countries to a multinational organization operating on the world stage is often a radical innovation for start-ups. Not only is more research needed into the issues associated with internationalization, there is also a demand for suitable education that matches this. This requires students who have the knowledge, attitude and skills to work in an international environment, to address issues related to internationalization and generally "internationally competent".

Base on the context sketched above, within the "Glocal" Business Creation, Development and Sustainable Employability model, Sustainable Employability is perceived as Output. Therefore students, startups and SME's and researchers' international transferable entrepreneurial skills are molded and transformed into value co-creation within the micro and meso-level labour market dynamics as sustainable employability output.

The sharing of information across countries is critical for finding opportunities, making adaptation decisions, and connecting social networks with mobility for international entrepreneurship. There is also evidence that the social network could be the aforementioned as a union between internationalization and innovation, as interpersonal connections developed in a new market, coupled with strategic connections from the local market can stimulate innovation and co-creation of new business models and business. However, findings suggest that a different view of business opportunities is facilitated by the cognitive distance from the market in which the entrepreneur enters [7].

In general, the term sustainable employability refers to the extent to which an employee is capable of gaining and maintaining employment [8]. It encompasses the

ability to move self-sufficiently within the labor market in order to realize potential through sustainable employment. In narrower definitions, employability only encompasses assets, such as knowledge and skills [9]. However, for individuals, employability also depends on attitudes they possess, their use of these assets, and their presentation of these assets to employers. In addition, employability depends on the context (e.g., personal circumstances and labor market environment) within which individuals seek work [8].

Throughout Western societies, changes have marked a move away from a paternalistic towards a performance culture – from providing lifetime employment in one working organization to requiring an individual's sustainable employability in different settings, as start-ups or SME's [10]. In the past decades, the concept of employability has received a lot of research attention, and it has been conceptualized based on micro-level competence-based views (antecedents or inputs of employability) rather than more meso-level labor market perceptions of employability (employability as an outcome). Within the so-called input-based approach of employability, scholars look at knowledge, skills and attitudes, or more general, competencies to assess employability [11, 12].

The practice-oriented research of the research benefits the regional consortium of start-ups and SME's while the research results are often directly applicable to the region, for example by adapting regional policy (local government level), by applying recommendations and providing practical insight into internationalization strategies (start-ups and SME's level) or by direct input for an even more personalized education (university level). For this reason, a collaboration in a triple co-creation context is reflected in almost all research activities to be carried out in the future.

3 Conclusions and Further Recommendations

In a globalizing world, it is necessary for SMEs to withstand competition from developed and emerging economies and to respond to the opportunities of internationalization. There is a link between internationalization and performance - it stimulates growth, employment, improves competitiveness and has a positive effect on the continuity of organizations. Under the influence of globalization, more and more companies are asking themselves whether internationalization is an option to achieve growth. The importance of small and medium-sized businesses for the Dutch economy is great as SMEs not only play a major role in society, for example as an employer, but also through creative destruction, or as a driver of change in the economy through the introduction of new products or services [13].

In line with the HAN Institutional Plan 2020 [14], this model has a threefold expected Impact in line with the co-creation of knowledge triangle Education, Research and Professional Field:

- Increased set of skills, both research-related and transferable ones, leading to improved employability and career prospects both in and outside academia (leading in the longer-term to more successful careers).
- Increase in higher impact output where more relevant to the professional field knowledge where ideas will be converted into products and services as result of improved

and enhanced International Entrepreneurship courses in the International Business Programme or International Entrepreneurship Minors.
- Greater contribution to the local knowledge-based economy and society to educational programmes.
- Enhanced cooperation and better transfer of knowledge between business sectors and international academic disciplines: management, marketing, logistics, HRM, finance, etc.
- Improvement in the quality of training programmes, internships and graduation assignments to a close supervision from researchers and local entrepreneurs involved.
- Enhanced cooperation and stronger networks internationally.
- Increase in international, interdisciplinary and intersectoral mobility of researchers and strengthen international human capital base in Research and Innovation with more entrepreneurial and better trained researchers.
- Better quality research and innovation for local and international competitiveness and growth with greater contribution to the knowledge-based economy and society.
- Boosting Research and Innovation capacity among participating startups and SME's with increased internationalisation of participants.
- Strengthening of international, intersectoral and interdisciplinary collaborative networks that will reinforce the startups and SME's position and visibility at a global level, but also at a regional/national level by helping them become key actors and partners in the local socio-economic ecosystems.

Throughout International Entrepreneurship is possible to build strong relationships between individuals in social and economic networks. As opposed to traditional networking and other business connections, social relations facilitate exchanges that are nourished mainly by support provided not only to communities in need but also to the entrepreneurs. By the same token, sharing information and resources amongst communities can be beneficial to similar entrepreneurial and social groups from different parts of the world for a more responsive business to create economic and social value.

References

1. Leloux, M., Popescu, F., Koops, A.: New skills for entrepreneurial researchers. In: Kantola, J., Barath, T., Nazir, S., Andre, T. (eds.) Advances in Human Factors, Business Management, Training and Education. Advances in Intelligent Systems and Computing, vol. 498, pp. 1251–1263. Springer, Cham (2017)
2. Mansfield, R.S., McClelland, D.C., Spencer, L.M., Santiago, J.: The identification and assessment of competencies and other personal characteristics of entrepreneurs in developing countries, Final Report: Project No. 936-5314, Entrepreneurship and Small Enterprise Development, Contract No. DAN-5314-C-00-3065-00. United States Agency for International Development, Washington, McBer, Boston (1987)
3. Grecu, V., Deneş, C.: Benefits of entrepreneurship education and training for engineering students (2017). https://doi.org/10.1051/matecconf/201712112007
4. PWC: Workforce of the future: The competing forces shaping (2030). https://www.pwc.com/gx/en/services/people-organisation/workforce-of-thefuture/workforce-of-the-future-the-competing-forces-shaping-2030-pwc.pdf

5. Till, A.L., Vesselina, R., Saadia, Z.: The Future of Jobs: Employment, Skills and Workforce Strategy for the Fourth Industrial Revolution. Report. World Economic Forum, Cologny (2016). http://www3.weforum.org/docs/Media/WEF_Future_of_Jobs_embargoed.pdf
6. Graduate Management Admission Council (GMAC): Employability and Business School Graduates: Corporate Recruiters Survey (2019). https://www.gmac.com/-/media/files/gmac/research/employment-outlook/employability-and-business-school-graduates_corporate-recruiters-survey-2019.pdf
7. Hagen, B., Denicolai, S., Zucchella, A.: International entrepreneurship at the crossroads between innovation and internationalization. J. Int. Entrepreneurship **12**, 111–114 (2014). https://doi.org/10.1007/s10843-014-0130-8
8. Hillage, J., Pollard, E.: Employability: Developing a Framework for Policy Analysis. DfEE, London (1998)
9. Rothwell, A., Arnold, J.: Self-perceived employability: development and validation of a scale. Pers. Rev. **36**(5), 23–41 (2007)
10. Pak, K., Kooij, D.T.A.M., De Lange, A.H., Van Veldhoven, M.J.P.M.: Human resource management and the ability, motivation and opportunity to continue working: a review of quantitative studies. Hum. Resour. Manag. Rev. **29**(3), 336–352 (2019). https://doi.org/10.1016/j.hrmr.2018.07.002. ISSN 1053-4822
11. Fugate, M., Kinicki, A.J.: A dispositional approach to employability: development of a measure and test of implications for employee to organizational change. J. Occup. Organ. Psychol. **81**(3), 503–527 (2008)
12. Van der Heijde, C.M., Van der Heijden, B.I.J.M.: A competence-based and multidimensional operationalization and measurement of employability. Hum. Resour. Manag. **45**, 449–476 (2006)
13. Dutch Committee for Entrepreneurship and Financing: State of SMEs Annual Report (2016)
14. Institutional Plan: HAN University of Applied Sciences (2016–2020)

Youth Workers and Innovative Development of Social Work

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Abstract. We conducted the research taking into consideration the fact that in organization of the professional training of a social worker for work with young people it is necessary to focus on the formation of high level professional culture, the development of the needs for constant professional development, as these should guarantee the success and effectiveness of the activities in the modern educational environment. The purpose of the experimental work was to check the competences gained at the workshops of the Youth Centre "START" and to determine the relevance of such competences. The survey engaged 48 participants who were students obtaining Bachelor and Master degrees at Social and Psychological Education Department in Pavlo Tychyna Uman State Pedagogical University. The respondents chose 13 competences among 31 proposed positions. In student youth's opinion, the youth worker should have basic competences. As a result we identified 5 main competences, which students had claimed in their questionnaire as the most relevant ones. The results of the research confirm the opinion that in the process of organizing the professional preparation of a social worker to work with young people, it is necessary to emphasize the formation of a high level of professional culture, the development of needs for continuous professional self-improvement, which is a guarantee of success and efficiency of activities in a modern educational environment. Therefore, the development of the theory and practice of vocational training for youth workers is on the agenda; research of the problem of the subjects of social and educational sphere in preparation of social workers for work with youth; development of theoretical and methodological bases and recommendations for training specialists for youth work; scientific support for youth policy areas; practical application of scientific research in youth work, etc.

Keywords: Youth work · Youth policy · Competences · Workshop · Bachelors · Masters

1 Introduction

Modern youth as a specific social group is the subject of special attention in contemporary society, as the changes in the social, economic and political system of Ukraine have impact on the consciousness and behaviour of the younger generation. Today, in various

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spheres of life democratic processes are observed as the civil society is being built and opportunities for personal development, manifestation of initiative and creativity are being provided.

Implementation of youth policies is one of the leading directions in the state functioning. At the same time, the issue of development and testing of new technologies for working with different categories of youth, normative and legal support of the state social policy for youth is especially important. The youth is considered as an object of national interests, one of the main factors in ensuring the development of the state and society and it influences a number of legislative acts and government programs.

In all countries there are youth policy executive authorities and as a rule their staff includes workers from local self-government bodies, youth organizations and institutions. The analysis of staff quality shows that a significant part of workers is deprived of necessary professional qualifications and practical experience; consequently, there is a lack of professional competences. Human resources development for work with youth is one of the key tasks in Ukraine. The future of the state largely depends on the civic position of younger generation, and this increases the importance of managing the processes of national and patriotic development of future social workers for work with youth during their studying at an institution of higher education.

2 Literature Review

Some aspects of social workers' training for professional activities are highlighted in the works of domestic and foreign scholars. For instance, the manual reveals the theoretical and applied aspects of social work in the community, analyses various models and approaches to the organization of this type of activity. The author describes contemporary approaches, gives retrospective review of social work in the community, substantiates the theoretical foundations of social work, and provides examples of social project development and its implementation in the community [2]. Another scientific work presents the theoretical foundations, content and organization of social work, offers forms and methods of social work with different categories of clients, includes the description of functions and areas of social workers' activity, their personal traits, the ethical principles of activity and ethical norms of social workers' behaviour [4].

The researches devoted to social work with children and young people are rather valuable for modern science. In the work by A. Kapska some aspects and peculiarities of social workers' activities with children having functional limitations are highlighted, the main features of social and pedagogical work with children deprived of parental care, difficult children, and communicative culture of adolescents and prevention of negative phenomena in the youth environment are defined. It presents the conclusion that cooperation with voluntary assistants can be an option in help to such children and young people, and the community is one of the factors of social influence on a person [5].

A. Kulikova in her study stresses that Sweden model of social workers' vocational training is different from others. There are three levels of training for social workers in institutions of higher education. The basic course is designed for two semesters and provides a general learning of social sciences. Introduction to the course gives students the

information about the purpose and content of the program, teaching methods, profession peculiarities, student associations and offers forms for student participation in the work of various committees. The main goal is to give them an opportunity to reflect on their choice of subjects and professional specialization. The basic course includes mastering Psychology, Sociology, Methods of Social Work, Political Science, Economics, Social Policy and Statistics. It is followed by one semester practice, and then by a two-semester theoretical course on Social Work. The students also have a five-month practice, after which they study an intensive course of Social Work. Before graduation every student must write a report by choosing one of the topics on the course [6].

The scientific study by G. Leschuk [7] notes that in France there is a differentiated multilevel system of social education based on an early career guidance, which usually begins at school, lyceum or by the means of educational program specialization. The structure of social education system in France is based on a number of principles: the principle of alternate learning, the principle of universality, the principle of individualization in education, the principle of modular organization of the educational process, the principle of modelling professional activities in the educational process. The modern system of vocational training of specialists in the social sphere of France is characterized by close interaction between educational institutions, where theoretical training is carried out, and social services and institutions that become the bases for practical training. The preparation of specialists in the field of social work in France is mostly based on the principle of alternate learning, when the theoretical education and the periods of practice in various educational institutions, social services, institutions and organizations are rotated and both components of specialists' training are carried out according to common program, pursue a common goal and are evaluated by well-defined criteria. Besides, during their studying, students have several types of practice [7].

Foreign practices play important role in youth social policy in the process of reforming the system of social work in Ukraine. In Europe youth work is carried out by numerous institutions and organizations, as well as by many different people, individually or in teams, and consequently, its forms are diverse. Some countries have their own traditions of professional work with youth (skilled personnel works with young people in local and national programs which are financed by the state). In other countries, some departments of volunteer work with youth were established long time ago (activities are undertaken by civic organizations). However, some countries identified youth work as part of the activities for population social security and as the practice included into services of employment departments or involved into social integration and social assistance. In other countries youth work takes place without profession of a youth worker being recognized and the people involved in such activities are just volunteers.

The Council of Europe has developed an online tool "Youth Work Portfolio" [9] which helps professionals, teams and organizations involved in youth work throughout Europe understand their competences and develop them effectively. This toolkit can also be used by youth work managers, politicians and those who are interested in the issue of effective development and recognition of youth work. Youth Work Portfolio of the Council of Europe is an instrument that helps those who carry out youth work (youth workers and youth leaders, as well as managers and administrators) analyse and develop their own competences in youth work and competences of people they work with [9].

In the great number of research works the important aspects of professional training of a worker of social sphere in general and a social worker in particular are revealed. However, there are few studies which present the role of a youth worker in the field of innovative development of social work and substantiate theoretical and methodological basis for preparing future social workers for youth work.

3 Materials and Methods

Our research is based the fact that in the process of organizing the professional training of a social worker for work with young people it is necessary to focus on the formation of professional culture of a high level, the needs for constant professional development, which can result in the successful and effective activities in the modern educational environment.

The purpose of the experimental work was to check the competences gained at the workshops held by Youth Centre "START" and to determine their relevance.

In the process of determining the role of a youth worker in the field of innovative development of social work and substantiation of theoretical and methodological fundamentals for future social workers' preparation for youth work, a series of workshops was conducted in the first term of 2018–2019 academic year. They were aimed at providing theoretical knowledge on the formation of practical skills in the field of youth policy and youth work implementation. The survey was conducted to find out how the participants self-assess their knowledge of youth policy and youth work at the beginning of the workshops (first stage), evaluate theoretical knowledge and practical skills at the end of the workshops (second stage), and what competences they choose among the main ones inherent to a modern youth worker (the third stage).

We engaged 48 participants (30 females and 18 males) obtaining Bachelor and Master Degrees at Social and Psychological Education Department in Pavlo Tychyna Uman State Pedagogical University. The research applied a set of interrelated theoretical and empirical methods: analysis, comparison and synthesis of information in scientific sources on the problem being investigated, the analysis of the theory and practice of youth work and the development of a set of professional competences of youth workers; observation, interviews and questionnaires used to diagnose the level of future social workers' awareness on the role of youth work and its importance for the development of social policy, the level of self-knowledge in youth policy, youth work, assessment of theoretical knowledge and practical skills, a list of competences which a modern youth worker should have; moulding experiment i.e. a series of workshops aimed at providing theoretical knowledge on the formation of practical skills for youth policy and youth work implementation.

In 2018 Youth Centre "START" [8] was created and now is functioning in Pavlo Tychyna Uman State Pedagogical University. The main aim of the centre activities is to comprehensively develop and promote self-realization of youth in various spheres of public life, to discover the youth potential, to protect youth interests and rights; to promote formation and development in the society, professional orientation, to organize interesting leisure time activities and to support talented youth.

The Centre has defined several main directions of its functioning. The educational and scientific activities are aimed at development of self-management through non-formal education, organization of forums, scientific conferences, seminars, formal meetings, discussion clubs on various aspects of the youth movement; training and retraining of youth workers through the organization of lectures, workshops, development of youth entrepreneurship; adoption of modern mechanisms of youth policy of the Council of Europe through international partnership, internships, cultural and educational exchanges. The entertainment activities are realized through organizing and conducting cultural events (concerts, performances, presentations, festivals, benefits, literary and song festivals, theatrical and concert evenings, creative meetings, artistic reports, intellectual games, competitions, tournaments, sports, entertaining and recreational events, health-improving events, dancing evenings, balls, discos, etc.); providing sports development of the youth; promoting the revival of spirituality, strengthening moral principles, organizing interesting leisure time activities.

The purpose of the information and consultation activities is to provide legal, informational, methodical and consultative assistance to youth; to form a powerful youth media resource i.e. an interactive press centre with media co-working; to actively cooperate with the community and volunteer organizations of the city and to develop youth volunteering. The project activities have the goal to support projects of student self-management bodies, entrepreneurial initiatives of the youth, to involve young people into interesting events during their free time; to assist the development of youth initiatives on labour, training and retraining of young people; to organize and hold competitions, projects, actions aimed at solving youth problems.

The vocational guidance activities assist young people to choose the future specialty through vocational guidance, workshops, visits to companies, acquaintance with representatives of different professions. The mentoring activities are chosen to promote and support youth effective projects, to provide management, fundraising, budgeting assistance, to search volunteers etc. [8].

The framework of Youth Centre "START" in Pavlo Tychyna Uman State Pedagogical University involved some events (workshops and seminars) in 2018 that were held in accordance with the work plan of the Centre. The programs of the following events were collected: workshops on creating start-up projects, the workshop on personal growth and development of leadership qualities; master classes by successful youth leaders, the youth forum "Public Education for Youth: the State and Prospects of Development", the workshop "Youth Policy and Youth Work in Ukraine", lady and gentleman school for youth, round table "Civic Competence of Youth", etc.

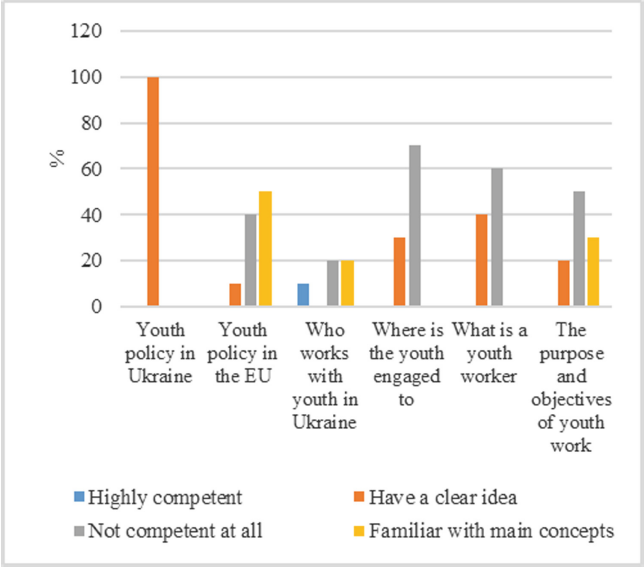
One of the workshops was aimed at providing theoretical knowledge on the formation of practical skills in the field of youth policies and youth work. During the workshop we held the survey consisting of 3 stages and consequently 3 questionnaires were given to the students. The first stage included the questionnaire to find out the current level of participants' knowledge of youth policy and youth work peculiarities. Other 2 questionnaires had the aim to assess theoretical knowledge and practical skills at the end of the workshop (second stage) and to make up a list of competences a modern youth worker should have (the third stage). At the first stage, during the workshop "Youth Policy and Youth Work in Ukraine" the questionnaire consisting of 3 questions was proposed to

the participants. The first block of questions consisted of 6 options (1. Youth policy in Ukraine. 2. Youth policy in the EU. 3. Who works with youth in Ukraine? 4. Where is the youth engaged to? 5. What is a youth worker? 6. The purpose and objectives of youth work), which the participant had to evaluate using 1–4 point scale, where 1 – not competent at all, 2 – familiar with main concepts, 3 – have clear idea, and 4 – highly competent. The second question "What helps you to get the information about the development of youth work in Ukraine?" proposed the following options: 1. Studying process (seminars, workshops, etc.); 2. Reading scientific and methodological articles; 3. Communication with practitioners; 4. Internet resources; 5. Your own answer). The third question "What forms of youth work are you engaged to?" had such answers: 1. Non-governmental organizations; 2. Mass events (flesh mobs, festivals, etc.); 3. Workshops, conferences; 4. Volunteer projects; 5. Youth programs (region, district, city); 6. Your own point of view.

At the second stage of the survey (at the end of the workshop) the questionnaire was proposed to the participants and they were expected to answer 3 questions. The first block of questions consisted of the same 6 items (1. Youth policy in Ukraine. 2. Youth policy in the EU. 3. Who works with youth in Ukraine? 4. Where is the youth engaged to? 5. What is a youth worker? 6. The purpose and objectives of youth work) to be evaluated according to 1–4 point scale so we could compare the participants' answers with the first stage questionnaire. The second question "Would you like to become a youth worker?" provided the following answers: yes; no; not sure; difficult to give a definite answer. The third question "What workshop modules were the most interesting to you?" proposed such options as 1. Youth policy. 2. Youth work. 3. Youth worker.

The third stage was held to find out the participants' points of view on what competences are necessary for youth workers.

Table 1. The results of the survey (1st stage of the study)



4 Results

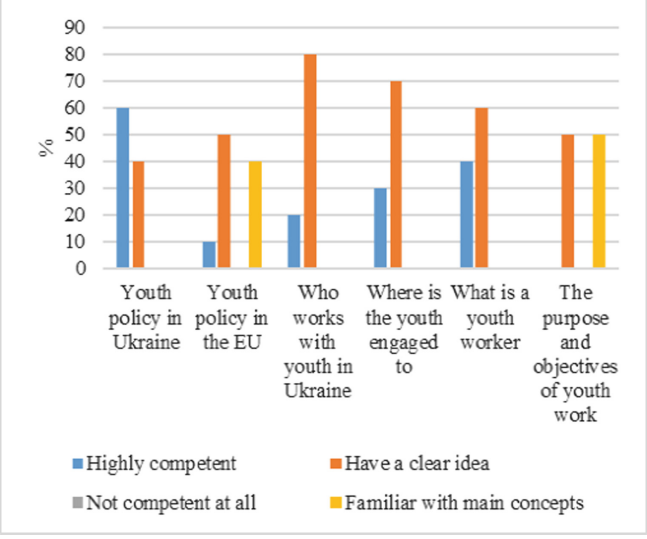
The results on the evaluation of participants' theoretical and practical knowledge in the field of youth policy and youth work in Ukraine are presented in the Table 1.

At the first stage of our research, it has been found that the participants at the beginning of the workshop have a clear idea of the youth policy in Ukraine; a half of the responders are familiar with the main concepts of youth policy in the EU, but 37,5% are not competent at all of this issue; 62,5% of participants have clear idea of who works with young people in Ukraine; most of the students were not competent at all of where young people are engaged to (75%) and what is a youth worker (62,5%).

The results of the questionnaire given to students at the second stage of the study showed that after the workshop "Youth Policy and Youth Work in Ukraine" students' knowledge improved. The answer "Youth policy in Ukraine" presented such results: 62,5% of respondents are highly competent of youth policy in Ukraine, and 37,5% have a clear idea of the issue. The option "Youth policy in the EU" resulted in such answers: 10% of responders are highly competent of the issue while 50% have clear idea and 40% are familiar with main concepts. The question "Who works with the youth in Ukraine" proved the fact that 20% of students are highly competent when 80% have clear idea of the issue. 20% of responders are highly competent of where the youth is engaged to and 80% have clear idea of the topic. The participants realize what a profession of a youth worker is (100%) and 37,5% are highly competent of the matter. A half of the students (50%) is familiar with main concepts and a half of responders (50%) has a clear idea of the purpose and tasks of youth work.

The results are presented in the Table 2.

Table 2. The results of the survey (2nd stage of the study)



The comparison of the results at the first and second stages of the survey led to the conclusion that the theoretical and practical materials presented in the workshop "Youth Policy and Youth Work in Ukraine" could give satisfactory results. Having analysed the answers to the second and third questions at the first and second stages of the survey, we received the following results. The answers to the second question "What helps you to get the information about the development of youth work in Ukraine?" were chosen from the proposed options, consequently, students receive information at seminars and workshops (25%), from Internet resources (25%), while studying courses "Social Youth Policy", "Social Policy" (50%). The question "What forms of youth work are you engaged to?" made the responders answered that they take part in workshops, round tables, conferences (62,5%), volunteer projects (25%), and youth programs (12,5%). The question "Would you like to become a youth worker?" provided such answers: yes – 62,5%, not sure – 12,5%, no – 12,5%. Choosing the most interesting topics at the workshops, the participants of the survey named such as Youth Policy (16,7%), Youth Work (58,3%) and Youth Worker (25%).

The results obtained from the third stage of our study showed the main competences that the youth worker must possess:

1. Relate to young people as equals – 22,2%;
2. Demonstrate openness in discussing young people's personal and emotional issues when raised in the youth work context – 11,1%;
3. Provide young people with appropriate guidance and feedback – 11,1%;
4. Support young people to develop their critical thinking and understanding about society and power, how social and political systems work, and how they can have an influence on them – 11,1%;
5. Build positive, non-judgemental relationships with young people – 9,5%;
6. Use a range of educational methods including ones that develop creativity and foster motivation for learning – 7,9%;
7. Support young people in identifying their learning needs, wishes and styles, taking any special needs into consideration – 7,9%;
8. Inform young people about learning opportunities and support them to use them effectively – 6,3%;
9. Assist young people to identify and take responsibility for the role they want to have in their community and society – 4,7%;
10. Actively include young people from a diverse range of backgrounds and identifications in youth work activities – 3,2%;
11. Understand the social context of young people's lives – 1,6%;
12. Support the competence and confidence development of young people – 1,6%;
13. Stay up to date on the latest youth research on the situation and needs of the young people – 1,6%.

Our research confirmed that one of the effective means of successful solving of different categories of younger generation problems is social work with youth, and that its level of organization affects the nature of teenagers' and young people's life, ultimately determines qualitative characteristics of young generation. Our results can be confirmed by studies of theoreticians and practitioners in the field of youth work.

In the modern society youth work is usually understood as an instrument for personal development, social integration and active citizenship of young people [1]; youth work is a "key word" for all types of social, cultural, educational or political activities that are realized together with young people, for them or by themselves [10]; youth work is characterized as value oriented, focused on the needs of young people, voluntary, developing, self-reflexive and critical, built on interpersonal relationships [10].

Our research allowed us to prove that providing youth infrastructure with qualified staff is the most important task among the measures taken by the state and local self-government bodies and must be aimed at developing the system of training, retraining and professional development of specialists in youth policies [3]. After conducting the research we came to the conclusion that one of the most effective means of youth work development is creation and operation of innovative units – youth centres. The main goal of such departments is the comprehensive development of youth potential and its self-realization in various spheres of public life, protection of interests and rights, contributing to social formation, development, professional orientation, organization of interesting leisure, and support of talented youth. The results of the study also confirmed the opinion that in the process of vocational training of a social worker for youth work it is necessary to focus on the formation of high level professional culture, the development of the needs for constant professional self-improvement, as these should guarantee the success and effectiveness of the activities in the modern educational environment. Therefore, there are relevant issues connected with development of the theory and practice of youth workers' training; investigation of the problems in social and educational sphere that prepare social workers for work with the youth; provision of youth policy with relevant researches; practical application of scientific research results in youth work, etc.

5 Conclusions

The research have showed that the participants of the mentioned workshops improved their theoretical knowledge and practical skills in the field of youth policy and youth work in Ukraine, although some theoretical information was obtained by the students during studying such courses as "Social Youth Policy" and "Social Policy". The students are active participants of various forms of youth work in Pavlo Tychyna Uman State Pedagogical University, and most of them want to work with the youth and become a youth worker in the future, as well as are interested in youth work.

Therefore, the respondents preferred 13 from the 31 proposed competences. In students' opinion a youth worker should have the basic competences, among which we identified 5 main ones stated in the questionnaire answers as the most relevant: relate to young people as; demonstrate openness in discussing young people's personal and emotional issues when raised in the youth work context, provide young people with appropriate guidance and feedback, support young people to develop their critical thinking and understanding about society and power, how social and political systems work, and how they can have an influence on them, build positive, non-judgemental relationships with young people. The results of the questionnaires have also showed a high level of future social workers' awareness on the role of youth work and its importance for the development of social policy in Ukraine.

In our opinion, a modern youth worker should possess not only the named above 13 competences, which have been allocated in the results of our research, but also all other ones, as the society is changing and youth work requires a universal worker who works for youth, together with the youth and makes the youth be active participant in social life. And in order to achieve the best results in his/her work a youth worker should take into account the needs and aspirations of young people, support them, develop their capabilities and be constantly young like his/her clients.

References

1. Biskup, V.: Sociology of youth: applied aspect. In: Reference for Work. Ternopil, Ukraine: Economy Idea, pp. 44–51 (2018). (in Ukrainian)
2. Bezpalko, O.: Interaction of children's public organizations and associations with various social institutions. In: Proceedings of the International Science Pract. Conference on Formation of Ideological Position of Adolescents in Children's Associations, Kyiv, pp. 10–13 (2011). (in Ukrainian)
3. Zhukorska, Ya.: Fundamentals of legislation in the youth policy. In: Reference for Work. Ternopil: Economy Idea, pp. 55–57 (2018). (in Ukrainian)
4. Zvierieva, I.: Social work: Tajik-Russian encyclopedic dictionary. UNICEF, Dushanbe, Tajikistan (2010). (in Ukrainian)
5. Kapska, A.: Social Work: Technological Aspect. Teaching, № 3 (2011). (in Ukrainian)
6. Kulikova, A.: Training of social workers for activities with children and young people in institutions of higher education in Sweden. Ph.D. thesis, Ligansk St. Univ. (2009). (in Ukrainian)
7. Leshchuk, G.: System of professional training of specialists in the social sphere in France. Ph.D. thesis, Ternopil St. Univ. (2009). (in Ukrainian)
8. Regulations on the youth centre "Start" in Pavlo Tychyna Uman State Pedagogical University, Uman, Ukraine: USPU (2018). (in Ukrainian)
9. Youth Work Portfolio. Council of Europe (2016). https://rm.coe.int/1680699d85/. Accessed 29 May
10. Yarema, O.: Introductory remarks by Oleksandr Yarema, a Deputy Minister of Youth and Sport of Ukraine. In: Reference for Work. Ternopil, Ukraine: Economy Idea, pp. 4–5 (2018). (in Ukrainian)

Educational Marketing and Hackathon for Candidate Student Recruitment

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Abstract. At present, the world faces opportunities and challenges in diverse sceneries: economic, social, technological, among others; further the making decisions influence adverse or beneficial within the local, regional or global community; the adoption, knowledge and use of new information technologies and the backing of professionals in computer science are fundamental at organizations. The decreasing student enrollment in information and communication technology (ICT) program in higher education in Mexico is a latent concern in the near and immediate future. This study is quantitative, non-experimental, transectional, descriptive and correlational. Data was collected on middle higher education student located in the Tijuana city. These results show that student who study area of specialization of computing science, do not know the general objective and profile of computer programs in higher education institution (HEI). This research article product derived doctoral thesis, present the hackathon-edu proposal in educational marketing (EM) for student recruitment in ICT professional career.

Keywords: Strategy blue ocean · Information technologies · Hackathon · Stem · Educational marketing · Higher education

1 Introduction

Information technologies are present in our daily life also are being used to drive economic and business growth, enhance the process at all sectors, such educational, medicine, bank and others; furthermore the trends on technologies such as cybersecurity, cloud, data analysis and internet of things, artificial intelligence, reality virtual and augmented, among others; additional the companies require professionals specialized IT in the near and immediate future; the important role HEI are recognized to produce the workforce development to contribute in the development process of a country in a globalized and interdependent world [1]. Organizations are will hire people to fill those positions according a study projected that these roles represent the future of IT and will add more than 829 thousand positions in Mexico by 2027 [2]. It is necessary to redefined a global strategy plan by HEI to guarantee ICT professionals skills and knowledge in contribute improvements and innovations through information technologies on the organizational goals. At 2016–2017 period the higher education in Mexico, specifically

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ICT knowledge area presented a low enrollment of 2.35% (96,184 students) by contrast 42.82% (1,753,898 students) social sciences programs [3]. At society, a large part of the responsibility in the training of students is absorbed by HEI, by example to develop the skills and competencies at Science, Technology, Engineering and Mathematics (STEM), social sciences, and other among disciplines. According at Hart research has mention the Association of American Colleges and University almost all of employers (95%) state that they will give preference to college graduates who can contribute to innovations in the workplace, with the opposite (93%) that only candidate demonstrate capacity to think critically, communicate clearly, and solve complex problems is more important than their undergraduate, furthermore at Selinger expose that employers desire professionals who demonstrate ability to contribute with solutions innovative at resolving problems [4]. The HEIs has develop strategies and activities to recruitment student is consequent global competition "universities and colleges face new challenges in student recruitment and international competition" [5]. As part of the marketing strategies within educational organizations, they seek and use the alternative solution that best suits the educational institution to attract students.

2 Educational Marketing in Higher Education at Mexico

Marketing perspective of the HEIs are seen as service organizations, and besides have developed in a stable and protected environment for a long time, as a result of globalization this environment has become more competitive and the context has been transformed, even modifying the type of training that society demand of the educational system and is vital that the administrators of HEI react in terms of marketing to these contextual changes [6]. In Tijuana, Mexico, research methodologies have been generated on the frontier of innovation, for the benefit of society, such as the case of the Fifth Helix Systemic (FHS) in Spanish it is known as Quinta Hélice Sistémica (QHS), for studies of sectoral integration and the evaluation of public policies [7].

Organizations must to be adapt changes world, applied the new strategies and technologies to show at market quality and efficiency educative work realized, perceived of form, furthermore of effective by society [8]. By means of educational marketing allowed enhance students is recruitments at higher education institution. The HEI role is transcendental for preparing the students and professionals to work force. On traditional method used at HEI is the first step to carry on recruitments process are identify population and interest them, by way by promotional events, conferences, talks, among others; the marketing process in manifest that actions by which companies create value for their customers and stable relationships with them to obtain an value exceptional in exchange, for achieve organizational goals [8–11], at Perez expose the EM is the investigation process about social needs to development and implementation programs that satisfy them, by way of exchanges and whose objective the benefit of the people and organizations of the community which interest [12], EM is seen as a service, the ICT as a support has revolutionized the service industries, created some, and forced others to redefine their process [13] and also Deshields, Kara and Kaynak, mention that increasingly the HEI are recognized as services industries that put priority customer satisfaction and universities management suitable [14], the participation HEIs on knowledge creation are represents

learning, developments and investigation to impact growth at regions consequently the advancement of science and technology has had an incremental and rapid progress in some disciplines (computing, biology, biomedical, nanotechnology, services, robotics and communications) following transdisciplinary integration [15–18]. Today more than ever, HEI in around world must be attentive to their environment, since the responsibility for the formation of human capital falls on them and that the latter in the not too distant future will be immersed in the substantive activities demanded by private industry or publishes. In this context, "the current configuration of Mexico's system of higher education is characterized by the complexity of its academic functions and by the diversity of institutions and the education offered" [19].

3 Hackathon

The concept hackathon was defined as social event focused to building, design, or develop of prototype with innovative solutions for attend needs at local, regional or global context [20, 21] furthermore "seen as an innovative new way to attack problems, hackathons have gained widespread application in many platforms beyond the conventional tech world" [4] extensive applications such librarians [21], astronomy [22], big data [23], introductory marketing class project [4] teach management consulting [24], learning of digital theology course [25], collaboration between public health experts and data scientists [26], development team recruitment by organization and open government [27]. The idea of "hackathons originated in the IT community as computing marathons where programmers, project managers, and graphic and interface designers collaborated intensively on software projects to design the next 'killer app' over one or two labor intensive days (Leckart 2012)" [28]; and also "the word hackathon is combined from the words hack and marathon, where hack is used in the sense exploratory and investigate programming (not as a reference to committing a cybercrime)" [29]. The hackathons regularly handled a competition mode between all participants who's integrated on work teams. The organization people they present the event, the participants suggested ideas and integrated on work team based on skills and interest. Follow started the event duration at hours or from 24 to 72 h. At finished each team presents their results about the solution innovative at panel of people such organizers, stakeholders, programmers, among people). The best team are selected and pricing. On all event members team work together and collaborative, learn a new skill, development creativity process.

4 Methodology

At present investigation study is quantitative, non-experimental, transectional, descriptive and correlational. The population are 190 students of middle high education located in the Tijuana city; was defined the probabilistic quantitative focus. Data was collected on sample of 127 students. The questionnaire instruments were quantitative to get data of the demographics, vocational orientation and diffusion at program educational, that consist likert, and also for data analysis was used at SPSS computer program [30]. To validate the reliability instrument was used SPSS V 22.0 [30] software to get at Cronbach alpha coefficient, the value of reliability to obtained was 0.917 is excellent based on the questionnaire employed in [31].

5 Results

Table 1 presents the student community was asked about the specialty they were studying, a significant percentage of students (80%) equivalent to 102 students, stated that the specialty of programming and computer science; followed by the electronic, physical, and math specialty with a total (15%) students equivalent to 19 people.

Table 1. Students pursuing the specialty

	Frequency	Percentage	Valid percentage	Accumulated percentage
Administration, management, social sciences	1	0.8	0.8	0.8
Automation, maintenance, industrial	5	3.9	3.9	4.7
Electronics, physical, mathematics	19	15.0	15.0	19.7
Programming, informatics	102	80.3	80.3	100.0
Total	127	100.0	100.0	

Source: SPSS V 22.0 [30], software based on the questionnaire employed in (based on [31])

Table 2 presents the student community was asked about the ICT Engineering graduation profile, a significant percentage of students (40.2%) equivalent to 51 students, who do not have any information regarding the graduation profile of the ICT career.

Table 2. Students know the graduation profile of ICT Engineering

	Frequency	Percentage	Valid percentage	Accumulated percentage
None	51	40.2	40.2	40.2
Very low	25	19.7	19.7	59.8
Low	23	18.1	18.1	78.0
Undecided	15	11.8	11.8	89.8
High	9	7.1	7.1	96.9
Very high	4	3.1	3.1	100.0
Total	127	100.0	100.0	

Source: SPSS V 22.0 [30], based on the questionnaire employed in (based on [31])

Table 3 presents the student community was asked about the ICT Engineering grid plan, a significant percentage of students (47.2%) equivalent to 60 students, indicate that they do not have any information regarding the ICT career grid plan.

Table 3. Students know the reticular plan of ICT Engineering

	Frequency	Percentage	Valid percentage	Accumulatedpercentage
None	60	47.2	47.2	47.2
Very low	20	15.7	15.7	63.0
Low	23	18.1	18.1	81.1
Undecided	10	7.9	7.9	89.0
High	9	7.1	7.1	96.1
Very high	5	3.9	3.9	100.0
Total	127	100.0	100.0	

Source: SPSS V 22.0 [30], based on the questionnaire employed in (based on [31])

6 Conclusions

In accord conceptualization of educational marketing, and also the hackathon its uses in diverse disciplines; the author has proposed hackathon-edu (see Fig. 1) such innovation on EM to interest and recruitments students to information technology and communications career, through detect human talent on real time [31]. This are conformed by higher education institution, educative programs, candidate, stakeholders, professor, expert professional, internships student and hackathon.

The hackathon-edu proposed, described in this paper as a blue ocean strategy "are defined by untapped market space, demand creation, and the opportunity for highly profitable growth" [32], and as another alternative of educational marketing that would

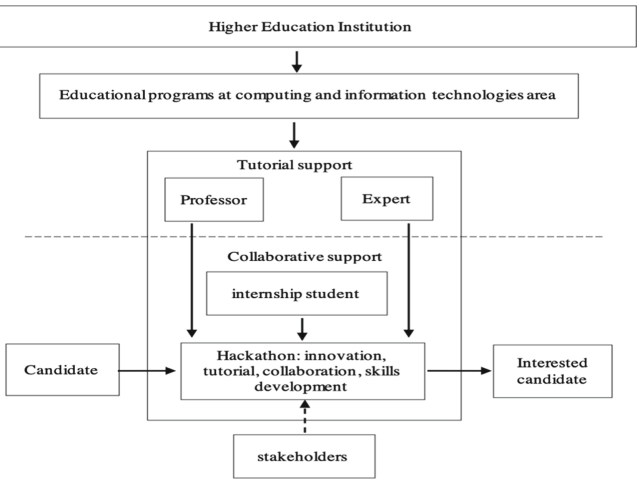

Fig. 1. Hackathon-edu. The figure shows the proposal to recruitments candidate for HEI at information and technologies communications career in (based on [31])

be used to interest and recruitment candidate for ICT career at HEIs in Mexico, furthermore shall allow become stronger relationships with stake-holders and interacting with the candidate to understand their needs and the development of innovative and viable solutions and also creating a significant value curve between traditional, digital and hackathon-edu marketing.

References

1. Hasan, F.A., Komoo, I., Nor, M.N.M., Abdullah, Z.: Transformation of universities and the national blue ocean strategy: a case study of Universiti Malaysia Terengganu. J. Sustain. Sci. Manag. **12**(1), 70–78 (2017)
2. Osores, M.: Veinte roles y trabajos de TI más requeridos en México, según Cisco. Search Data Center en español (2018). https://searchdatacenter.techtarget.com/es/noticias/252454584/Veinte-roles-de-trabajos-de-TI-mas-requeridos-en-Mexico-segun-Cisco
3. Dirección General de Educación Superior Universitaria.: Estadísticas Básicas de Educación Superior. Programa Nacional de la educación (2018). https://www.dgesu.ses.sep.gob.mx/EBESNACIONAL.aspx26
4. Calco, M., Veeck, A.: The markathon: adapting the hackathon model for an introductory marketing class project. Mark. Educ. Rev. **25**(1), 33–38 (2015)
5. Wu, T., Naidoo, V.: The role of international marketing in higher education. In: Wu, T., Naidoo, V. (eds.) International Marketing of Higher Education. Palgrave Macmillan, New York (2016)
6. Ospina, M., Sanabria, P.: Un enfoque de mercadeo de servicios educativos para la gestión de las organizaciones de educación superior en Colombia: el modelo Migme. Revista Facultad de Ciencias Económicas: Investigación y Reflexión **18**(2), 107–136 (2010)
7. Martínez Gutiérrez, R.: Quinta hélice sistémica (QHS), un método para evaluar la competitividad internacional del sector electrónico en baja california, méxico. Investigación Administrativa **41**(110), 34–48 (2012). ISSN 1870-6614
8. Guarisma, J., De Pelekais, C.: Hablemos de Marketing Educativo. Editorial Independently Published, United States (2020)
9. Cruz, C., Enciso, G., Forero, S., Garzón, C., Hoyos, R., Leyva, K., Linero, J., López, S., Maguina, O., Neme, S., Pereira, C., Riveros, G., Zitzmann, J.: Fundamentos de mercadeo, Primera edición. Ecoe ediciones, Bogotá (2017)
10. Ferrell, O., Hartline, M.: Estrategia de Marketing, Quinta edición. Cengage Learning, México, D.F. (2012)
11. Mullins, J., Walker, O., Boyd, H., Larréché, J.: Administración de marketing. Un enfoque en la toma estratégica de decisiones, Quinta Edición. McGraw-Hill/Interamericana Editores, S.A de C.V, México (2007)
12. Arrubla, J.: Marketing en universidades: Análisis de factores críticos de competitividad. Revista Escenarios Empresas y Territorio **2**(2), 207–225 (2013)
13. Stanton, W., Etzel, M., Walker, B.: Fundamentos de Marketing, Decimocuarta edicion. McGrawHill, México (2007)
14. Doña, L., Luque, T.: Relación entre marketing y universidad. Revisión teórica y propuesta de un modelo teórico y de marketing 3.0. Revista de Estudios Empresariales. Segunda época (2), 2–27 (2017)
15. Asociación Nacional de Universidades e Instituciones de Educación Superior: Visión y acción 2030. Propuesta de la ANUEIS para renovar la educación superior en México. Diseño y concertación de políticas publicas para impulsar el cambio institucional, México (2018)

16. Díaz, A.: Innovación, Tecnología y Conocimiento Ingredientes para impulsar el desarrollo sostenible en el país. Revista Ingeniería, Matemáticas y Ciencias de la Información **1**(2), 79–86 (2014)
17. Moreno-Brid, J., Ruiz-Nápoles, P.: La educación superior y el desarrollo económico en América Latina. Revista Iberoamericana de Educación Superior **1**(1), 171–188 (2010)
18. UNESCO: Hacia las sociedades del conocimiento. Ediciones UNESCO (2005)
19. Espinosa, A.: Privatization and marketing of higher education in Mexico. In: Geo-JaJa, M.A., Majhanovich, S. (eds.) Effects of Globalization on Education Systems and Development. The World Council of Comparative Education Societies. Sense Publishers, Rotterdam (2016)
20. Frey, F., Luks, M.: The innovation-driven hackathon - one means for accelerating innovation. In: Proceedings of the 21st European Conference on Pattern Languages of Programs (EuroPLoP 2016). ACM (2016)
21. Shin, N., Vela, K., Evans, K.: The research role of the librarian at a community health hackathon - a technical report. J. Med. Syst. **44**(2), 36 (2020)
22. Pe-Than, E., Momcheva, I., Tollerud, E., Herbsleb, J.: Hackathons for science, how and why? In: American Astronomical Society Meeting Abstracts, vol. 233, p. 459.11 (2019)
23. Gould, R.: Datafest: celebrating data in the data deluge. In: Sustainability in Statistics Education. Proceedings of the Ninth International Conference on Teaching Statistics (2014)
24. Maaravi, Y.: Using hackathons to teach management consulting. Innov. Educ. Teach. Int. **57**(2), 220–230 (2018)
25. Kolog, E., Sutinen, E., Nygren, E.: Hackathon for learning digital theology in computer science. Int. J. Mod. Educ. Comput. Sci. **8**(6), 1–12 (2016)
26. Bell, J., Murray, F., Davies, E.: An investigation of the features facilitating effective collaboration between public health experts and data scientists at a hackathon. Public Health **173**, 120–125 (2019)
27. Bortz, G.: El hackatón como metodología de producción de bienes informacionales: Limitaciones y desafíos en la producción de aplicaciones de software para la resolución de problemas sociales y ciudadanos. Hipertextos **1**(1), 133–162 (2013)
28. Kienzler, H., Fontanesi, C.: Learning through inquiry: a global health hackathon. Teach. High. Educ. **22**(2), 129–142 (2016)
29. Briscoe, G., Mulligan, C.: Digital Innovation: The Hackathon Phenomenon. Creativeworks London, no. 6, pp. 1–13 (2014)
30. IBM Corp.: Released 2013. IBM SPSS Statistics for Windows, Version 22.0. IBM Corp., Armonk (SPSS V 22.0) (2013). https://www.ibm.com/support/pages/how-cite-ibm-spss-statistics-or-earlier-versions-spss
31. Tapia, G.: Hackathon y sociedades del conocimiento: hacia un nuevo paradigma en marketing educativo (proyecto de tesis doctoral). Escuela de Negocios del Pacífico. Tijuana, México (2019)
32. Kim, W., Mauborgne, R.: Blue Ocean Strategy: How to Create Uncontested Market Space and Make Competition Irrelevant. Harvard Business School Press, Boston (2005)

Improving Quality

Successful Development of Virtual Teams in a Geographically Dispersed Electric Power Grid Company

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Abstract. Electric power grid operation companies are in need for renewal and restructuring due to the introduction of local renewable energy production and changed patterns of energy and effect consumption, combined with strong political incentives for electrification. This paper present how development of two supporting capabilities has contributed in improvement of organizational performance. The two capabilities are (1) analytics, the capacity and ability to process and analyze data, together with (2) collaboration, the capacity and ability to effectively involve relevant expertise and authority at the right time in decision making regardless of organizational and geographical location.

Keywords: Human factors · Organizational ergonomics · Capability development · Collaboration · Analytics

1 Introduction

In their World Energy Outlook, the Internation Energy Agency states the message clearly "The future is electrifying, with low-carbon technologies on the rise and electricity demand set to grow at twice the pace of energy demand as a whole" [1]. As a small country with a relatively large (~150TWh, 98% of total national production) renewable (hydropower and wind) electricity generation and a broad political will to push the electrification forward, Norway has given its electric power grid companies a clear responsibility for the work in electrification. This responsibility involves increased efficiency for inclusion of renewable energy and handling of a growing effect demand in the grid.

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For the grid companies work systems, this means an increased need for digitalization and smart use of data for decision support, automated workflows and handling tight integration with customers and suppliers. It also means that employees meet new requirements related to competency and ability to adapt to new ways of working.

In a three-year project supported by the Norwegian Research Council, Institute for Energy Technology (IFE) and a power grid company were performing a pilot study to identify and describe the organizational and technological capabilities that grid operators must possess in order to deliver in a future market. The project focused on system innovation rather than technology innovation, and addressed the challenges of identifying, integrating and implementing new technologies. A method identifying and defining organisational competences necessary for digitalisation in the oil industry, the Capability Approach [2–4], was therefore used to describe and develop the resources needed to enhance performance in the organization. The approach builds on the theoretical foundation for dynamic capabilities [5, 6]. To enable an effective change process, the organization was modelled as a three-level capability stack, with a middle layer consisting of capabilities that will support operations in meeting the new demands. Through identification of main drivers for transformation and description of competence needs, "Collaboration" and "Analytics" were identified as key organizational capabilities supporting a wide range of operative decisions [7, 8]. A number of user cases were identified to analyze, test and develop the identified capabilities in the organization [9].

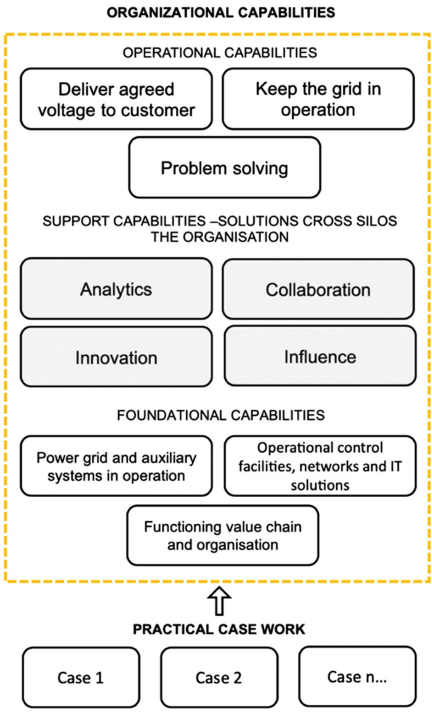

Fig. 1. Three layer capability stack model [9]

In this paper we describe and discuss how developing collaboration and analytics support capabilities in one of the organizations units enabled them to deliver on the operational level (Fig. 1). The paper further describes how a training approach from the offshore oil industry was used to develop the capabilities and how key performance indicators were used to monitor progress.

1.1 Analytics and Collaboration as Measures for Team Development

The main objective for the practical user case was to establish a more effective organization and use of expertise based on the upcoming access to data and new collaboration technology. As a consequence of the broad initiatives towards electrification, the company experienced a large volume of customer-initiated jobs related to new installations and modifications in the grid. This resulted in challenges on the status overview and

prioritization of the work portfolio, which, in turn, was suspected to cause lowered throughput of work orders and response time to the customer. The company had electric grid engineers for handling installation requests in 3 different geographical locations and for answering out more complex problems they were supported by relevant input from specialized competence spread in the organization. Typical for the organization was that most staff handled a wide specter of different inquiry types from the customers. Each geographical area was responsible for its own customers.

It was hypothesized that specialization of employees' work tasks and digitalized, real time information about the department's production would contribute to a common understanding of the situation in the teams (awareness raising). This would also encourage staff not to pick simple jobs from the list instead of taking jobs in sequential order from the time of enrollment. A more optimal order of job handling together with specialized competence would reduce the processing time for jobs.

1.2 Digital Solutions

Fig. 2. An example of how coffeeshop status boards were used to draw attention to production data

In order to handle the growing workload, it was searched for digitalization solutions that could increase efficiency. Measures were identified in the following three areas:

- Data based decision-making support for prioritization of work portfolio, both for managers and grid engineers.
- Simplification through automation (self-service) to avoid having all customers call in by phone.
- Use of collaboration technology for enabling collaboration across dispersed geographical locations.

The project used a common company enabled database and developed digitized follow-up of suppliers and access to data that gave the opportunity to improve internal prioritization. Data from the workflows were used for development of overview images showing the real time production data and throughput time status dashboards were developed and made available on the company collaboration platform (Microsoft Teams). In addition, monitors with status dashboard were placed in the office facilities coffeeshops as shown in Fig. 2.

1.3 Organizational Solutions

Using digital collaboration as an opportunity to reallocate roles and responsibilities, the organizational unit under study was changed from being geographically organized with full responsibility for three different geographical areas, to become two virtual teams with specialized responsibilities. A virtual team will here refer to a group of individuals who work together from different geographic locations and rely on communication technology.

Internally, collaboration meetings were used to follow up a number of measures. Weekly standup video meetings were established with the purpose of improving the teams' understanding of the workload situation, better compliance to work processes and establishing common work practices. These meetings also had a stated objective of training the employee to ask more questions in video meetings and to take more responsibility for presenting information that should be shared in the teams. To keep discussions on a level relevant for all participating staff and avoid spending too much time discussing details, the meetings had a strict agenda focusing on status, workload information and coordination between the participants.

To develop competence according to the collaboration capability, the Structured Observation and Feedback in Integrated Operations (SOFIO) method for collaboration training used in the Norwegian oil and gas industry [10] was adopted for on-the-job training. As a front runner in digitalization and digitally based collaboration, the offshore oil industry has provided a wide range of experience on how to successfully implement practical work systems for distributed work based on geographically dispersed teams [11]. The core of the SOFIO method is structured observation and feedback of video meetings for developing behavioral and technical skills for this type of collaboration setting. For a period of 7 months, approximately every second meeting was observed by an external observer who rated the meetings according to four dimensions (leadership/facilitation, presentation technique, technological literacy, and virtual meeting mindset). In the end of each meeting the observer gave direct feedback to the meeting on improvement potentials for all four dimensions and positive feedback to individual meeting participants for behavior in line with recommendations from [10]. A short reflection report was sent to the team leader after each meeting.

Towards the suppliers, the following measures were implemented:

- A contact center with a dedicated role in answering questions were established in order to reduce the number of people being interrupted in their work.
- Improved dialogue with supplier companies using web-based software (saving the supplier calling in for every job)

A special effort was also made for identifying and giving the right prioritization to customers that repeatedly contacted the organization with false positive plans for development projects.

2 Results and Discussion

Three different indicators were used to follow the development of the collaboration and analysis capabilities in the organizational unit. The main indicator was the company units

KPI for job flow, measuring processing time (days) from a job was registered until it was completed. As shown in Fig. 3, this measure was divided into 4 different categories of jobs and measured through the whole project period. Even if the number of jobs processed increased with about 5% in the three-year period, the average processing time decreased with approximately 50%, indicating a substantial effect of the implemented measures.

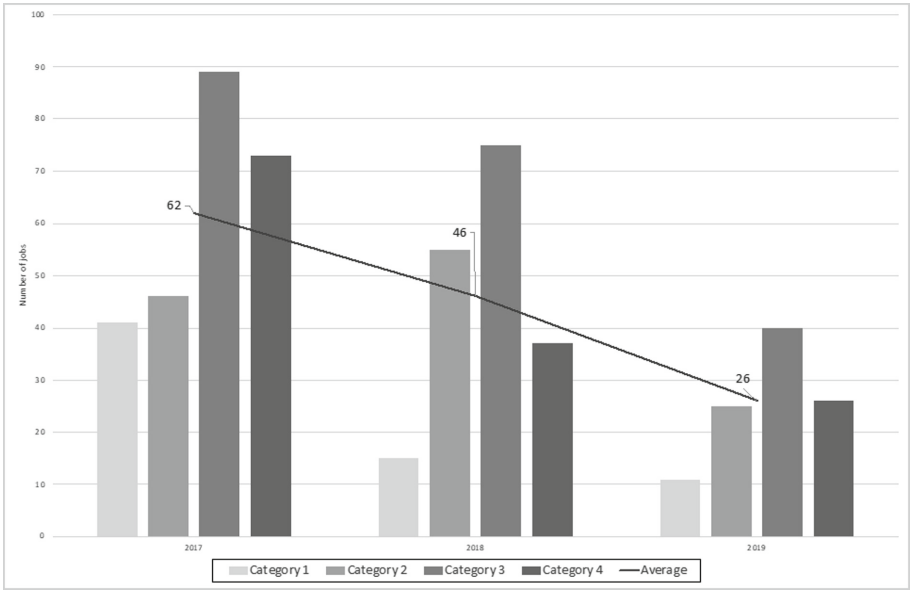

Fig. 3. Development in job processing time measured by number of days over three years.

Although the meeting observations were too few to quantify the results, they provided some interesting insights regarding the development of skills. Each meeting was given an individual score for all dimensions and an overall score for the meeting (indicator 2). The expected development was that the scores would gradually improve over time as the meeting participants became more experienced and used to the new virtual meeting form. However, the meeting assessments indicate that at a certain point, a significant shift occurred. It seems that the general understanding of what is required to achieve successful distributed meetings reached a turning point where participants better understood their own role in the meeting, also observed on the "virtual meeting mindset" rating. Along with bringing the technical literacy to a level where everyone mastered sound and image, they also developed a better understanding of what each individual had to do in order for the other participants to have as good an experience as possible from the meeting.

The third indicator of progress was more explorative and measured how often the team members checked the status progress dashboards. The purpose of the face to face meetings was to develop a way of working focused on efficiency, sharing culture and belonging regardless of physical location. The regular video conference-based meetings were deemed important to support the development of team processes and trust between

team members. However, the main measure to reduce engineers time spent on each job was to use the new shared data available together with more customer and vendor self-service and automation of work tasks.

Towards the end of the observation period, it was found that the proportion of employees (indicator 3) who regularly and on their own initiative checked status using their dashboards was at such a high level that the video meetings could be more focused towards alignment of work performance and discussion of specific challenges for each individual. It is also true that the numbers for processing time (Fig. 3) do not tell the whole story. There is a great variety in complexity between requests handled. The video meetings have therefore gradually also become a forum for discussion of special challenges. A challenge for further improvement is to organize meetings in such a way that they become interesting for everyone. Rules for meetings and work across teams outside of meetings will be a key to succeeding in developing the teams further.

3 Conclusions

This practical case example has shown that if an organisation is willing to invest in appropriate tools and training for the staff, the value from the investments in a virtual team organizational model will pay back in short time. The results from this study should not be interpreted as an isolated effect from the capability stack model (Fig. 1). However, using a holistic framework like the capability approach can be efficient both for the overall planning of organizational development as well as the implementation of specific measures like the organizational change discussed here.

In terms of purpose, theory and methods this is a typical macroergonomics project with a need to optimize the organisation design, work design, teamwork and telework processes [12]. As most macroergonomic methods are oriented towards improving existing systems and the choice methods for designing future systems is rather limited. Using the Capability Approach has helped the organisation to identify and address mechanisms that are relevant for their future short-to-medium term (i.e. 3–5 years) development.

Using the capability approach in a structured way to define and develop a set of common abilities for understanding and using analytics and collaboration tools is not relevant only for the specific purpose discussed here. Strengthening the organizations analytics and collaboration support capabilities implies is also a measure to educate and train the individual employee and empower individuals to see opportunities for further development of their own workplace.

References

1. IEA: International Energy Agency, World Energy Outlook (2018). https://www.iea.org/reports/world-energy-outlook-2018
2. Henderson, J., Hepsø, V., Mydland, Ø.: What is a capability platform approach to integrated operations? An introduction to key concepts. In: Rosendahl, T., Hepsø, V. (eds.) Integrated Operations in the Oil and Gas Industry: Sustainability and Capability Development, pp. 1–19. IGC Global, Hersey (2012)

3. Reegård, K., Drøivoldsmo, A., Rindal, G., Fernandes, A.: The Capability Approach to Integrated Operations Handbook, Center for Integrated Operations in the Petroleum Industry, Trondheim, Norway (2014)
4. Reegård Reegård, K., Drøivoldsmo, A., Rindahl, G., Fernandes, A.: Handbook - The Capability Approach to Integrated Operations, IFE/HR/F-2014/1604 (2014). http://www.iocenter.no/
5. Helfat, C.E., Peteraf, M.A.: The dynamic resource- based view: capability lifecycles. Strateg. Manag. J. **24**(10), 997–1010 (2003)
6. Teece, D.J., Pisano, G., Shuen, A.: Dynamic capabilities and strategic management. Strateg. Manag. J. **18**(7), 509–533 (1997)
7. Reegård, K., Drøivoldsmo, A., Farbrot, J.E., Hurlen, L.: Drivers for transforming the power grid company. In: Broberg, O., Seim, R. (eds.) Proceedings of the 50th Nordic Ergonomics and Human Factors Society Conference (2019). https://doi.org/10.11581/dtu:00000061
8. Reegård, K., Drøivoldsmo, A., Farbrot, J.E.: Defining organizational capabilities in an electric power distribution grid operator to meet future demands. This Conference (2020)
9. Hurlen, L., Farbrot, J.E., Drøivoldsmo, A., Reegård, K.: The power grid operator of the future: a case method for developing organizational capabilities required to successfully adapt in a fast-changing market. In: Proceedings of the 50th Nordic Ergonomics and Human Factors Society Conference (2019). https://doi.org/10.11581/dtu:00000061
10. Kaarstad, M., Rindahl, G., Torgersen, G.-E., Drøivoldsmo, A.: Presented at IEA 2009, 17th World Congress on Ergonomics, Beijing, China, 9–14 August 2009 (2009)
11. Rindahl, G., Torgersen, G.E., Kaarstad, M., Drøivoldsmo, A.: Collaboration and Interaction at Brage – Collecting the Features of Successful Collaboration that Training, Practices and Technology must support in Future Integrated Operations. IO Center Report No. P4.1-003, March 2009
12. IEA: International Ergonomics Association, Definition and Domains of Ergonomics. https://www.iea.cc/whats/index.html

Lean Manufacturing Model of Production Management Under the Focus on Maintenance Planned to Improve the Capacity Used in a Plastics Industry SME

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Abstract. Nowadays, SME industries in the plastics sector fail to work with their maximum installed capacity, among the main factors are lack of market, normal or inevitable and conventional or technical stops, will be dealt with in this investigation. The problem is evident in 71.45%, the average percentage of capacity used in the plastics industries in Peru. Therefore, this article proposes the development of a three-phase production model and complements the Planned Maintenance pillar with Lean tools that seek to improve the capacity used by 17% in industries in the sector. The model starts with the 5S as a basis and support to standardize the ordering and cleaning habits to continue with SMED and Planned Maintenance of TPM. The model was validated with an implementation, an 18% increase in the production capacity used, so it can be concluded that the proposal for improvement presented serves as a reference for future research.

Keywords: Planned maintenance · Lean Manufacturing · Capacity used · Plastics industry

1 Introduction

At present, worldwide annual plastic production is increasing with 359 million tons placed on the market in 2018, the sector increased by 3.2% compared to the previous year. For its part, 4% of the plastic-producing regions in the world are represented by Latin America [1]. However, only 38% of Latin American companies showed healthy production levels with a plant capacity utilization of +80% [2].

The most important problem for SMEs in the plastic sector is the plant's low capacity because they do not have adequate resource management affecting the non-acceptance

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of orders. A comprehensive production model for SMEs is proposed that considers as a main factor the downtime that allows to obtain results in a short time and achieves the elimination of the different kinds of waste recognized to reduce costs, increase productivity, increase quality and economic benefits. The proposal is a production model that uses lean techniques under the focus on planned maintenance to improve capacity used in a plastics industry SME, the first parallel action is to reduce cycle times aimed at increasing of the utilization rate of the machines and the second parallel action seeks to progressively bring the plant to zero waste whose goal is to gradually reach "zero breakdowns".

2 State of the Art

2.1 Lean Manufacturing

Their research is based on efforts to plan productivity improvement measures, according to the information lifting of managers companies had a more strategic perspective and looked at the whole company, but had trouble providing details of systems or specific policies [3]. Clarifying the concept of success and failure that are determined by organizational factors of leadership, people and processes rather than the various technologies, lean implementation models in SMEs are oriented in three phases to achieve the efficient implementation involved with social factors and flexible continuous improvement under any situation or process that takes advanced approaches; they also share the same concept about lean is a people process subject to what the real world says about the market, available resources and industrial conditions and prevailing environmental [4–7].

2.2 Maintenance Planned

The models presented can be applied in different plant and industrial lines to optimize the maintenance process, they also indicated that each component of the slender maintenance should be assessed differently and included in the implementation budget, evidence that in the short term the results reflect the planning of activities and the observation of the timetable set for implementation based on the training and training of the team to achieve job success [8]. They identify that the main indicator of planned maintenance is the OEE, as validating the quality component is key to the performance of the team ensuring profitability, image and competitiveness in the current economic crisis; further argued that maintenance activity should no longer be seen as a separate and isolated function that makes repairs i.e. should be considered as the potential area to achieve competitive advantage and involve the achievement of the objectives in the company to be carried out in a sustainable way [9, 10].

3 Collaborations

3.1 Proposed Model

With the information of the analyzed articles, a production model was made (Fig. 1).

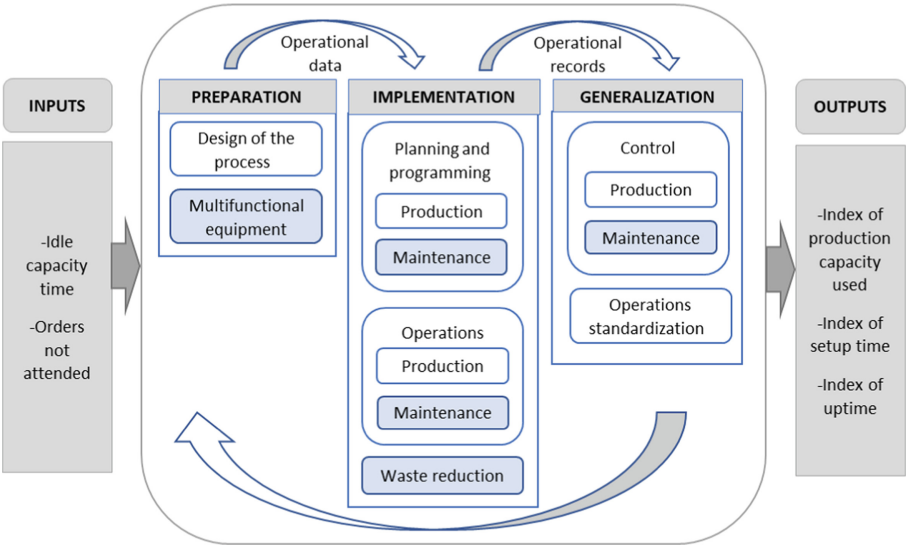

Fig. 1. General view of the proposed production model.

3.2 Proposed Model Process

A process flow diagram is prepared for the visualization of the steps of the application of the proposed production model, which is distributed in phases. See Fig. 2.

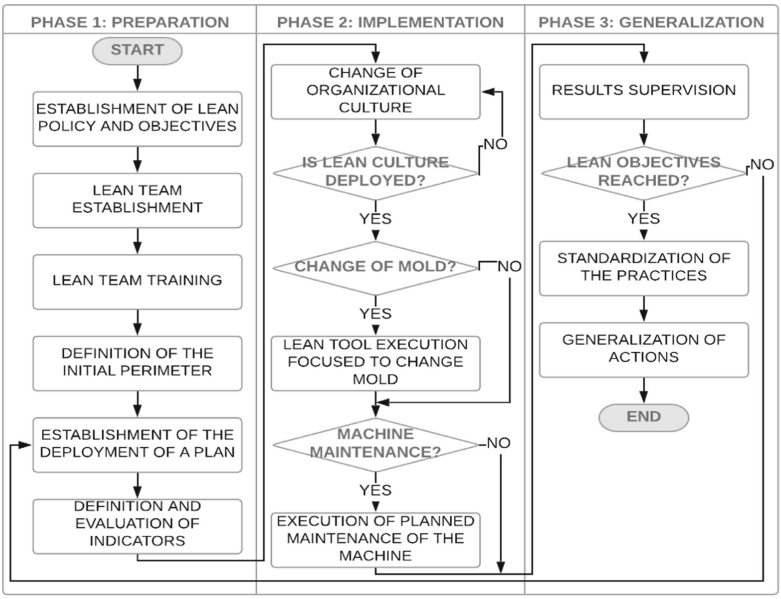

Fig. 2. Process of the proposed production model.

3.3 Indicators

See Table 1.

Table 1. Indicators of the proposed production model.

Indicator	Formula	Description
Index of CUp	(Real production (hrs.)/Installed capacity (hrs.)) * 100	The proximity of the real production with the production capacity in ideal conditions of an organization is visualized
Index of setup time	((Initial time – Final time)/Initial time) * 100	Includes the time of the initial situation and the time of the final situation of the change of mold of the machine
Index of uptime	(Σ (Time without breakdowns)/Planned time) * 100	It calculates the percentage that the machine is operational, that is, it only discounts losses due to breakdowns of the planned time to produce

4 Validation

4.1 Describe the Scenario

The SME under study is a small company located in Lima and dedicated to the manufacture of injection molded plastic items for household items. The production area consists of 4 product lines, which are benches, buckets, trays and chairs. The production capacity of the SME under study is below the standard of 71.45% corresponding to the plastics industry in Peru, this is reflected in the increase in the number of orders not attended, of the idle capacity costs and overtime hours costs, which generates a negative economic impact equivalent to 23.2% to total annual sales. Therefore, in order to mitigate this problem, SMED, Planned Maintenance and 5S were applied.

4.2 Validation of the Proposed Model

The steps taken in the implementation phase of the proposed model are detailed below:

Step 1: Change of Organizational Culture. The 5S implementation was carried out in the production area and in the spare parts warehouse, which improved the workforce and work areas.

Table 2 shows that the result of the initial and final situation of each work area. In the 5S closing audit in each work area was 100%, that is, the 5S implementation was positive in changing the culture of the adjusted team, so a meeting was held with the general manager for the approval of the execution of SMED for the change of mold and of Maintenance Planned for the maintenance of the machines of injection.

Table 2. Initial situation vs Final situation of work areas through the 5 s audit

Work areas	Audits		Difference
	Initial	Final	
Production area	28%	100%	72%
Spare parts warehouse	19%	100%	81%

Step 2: Lean Tool Execution Focused to Change Mold. First, an SMED training was carried out on the Lean team Then, the current activities were examined with the Mold change analysis record (Fig. 3).

PRD-RE-011 Date: 30/06/19 Version: 00	MOLD CHANGE ANALYSIS RECORD							
TYPE OF INJECTION MACHINE: B	**LINE / PRODUCT:** Tray / Tray Ola Ola		**RESPONSIBLE / POSITION:** J.V./Mach. B - C.M./Op. B			**DATE:** 03/02/2019		
RESPONSIBLE LEAN / POSITION: M.G.P./Mach. D - M.J.A./Op. D						**DATE OF ANALYSIS:** 29/08/2019		
No	**DESCRIPTION**	**1° STEP**		...	...	**4° STEP**		**OBSERVATIONS**
		TOTAL TIME (00:00:00)	**DURATION (00:00:00)**	...	...	**ACTIVITY**		
						EXTERNAL	**INTERNAL**	
1	STOP THE INJECTION MACHINE	00:00:36	00:00:36	...	...		00:00:36	NONE
...	...	...	...	...	...	...	...	...
40	TURN ON AND CALIBER THE INJECTION MACHINE	**04:09:00**	00:05:13	...	...		00:05:13	NONE
TOTAL			**04:09:00**	...	...	**01:42:34**	**02:04:03**	REDUCTION OF 50.17% OF THE INITIAL SETUP TIME

Fig. 3. Application of the Mold change analysis record in the injection molding machine B.

In Fig. 3, the register applied to an injection machine is shown, of which it was possible to reduce from 40 activities to 31. Finally, with the analysis of the previous register, two mandatory registrations are made, which must be used when making each change of mold. The first record, Mold change observation sheet, contains the 31 sequential activities and their durations are detailed. It should be noted that the total duration time will be used for the analysis of the setup time index indicator. The second record, Check list of activities before and after the change of mold, details four and two activities that must be performed before and after the change of mold respectively.

Step 3: Execution of Planned Maintenance of the Machine. First, the planned Maintenance training was carried out to the lean team. Second, the data of the injection machines such as type, code and important parts were recorded on a technical sheet. Third, the initial condition of the injection machines was evaluated, in order to ensure that each one is in optimal condition to start with the planned maintenance. Fourth, the maintenance plan for the injection machines and their auxiliary equipment were elaborated and, in addition, the lubrication plan for the injection machines.

Finally, the mandatory registration that should be applied when performing each maintenance was established, which can be preventive, whose maintenance will be applied according to the plans established for each injection machine, or corrective (Fig. 4), whose maintenance time will be used for the analysis of the uptime index indicator.

PRD-RE-016 Date: 30/06/19 Version: 00	MAINTENANCE RECORD		
Type of injection machine: C		Date: 13/09/19	N°: 020
CORRECTIVE MAINTENANCE			SPARE PARTS USED
REASON	FAILURE		
HYDRAULIC	Oil leak through the cylinders		CYLINDER O'RINGS
OBSERVATIONS			
The machine is stopped due to loss and low oil level. Lack of oil can damage other parts.			
TIME THE MACHINE STOPPED	START TIME		MAINTENANCE TIME
9:56 a.m.	12:26 p.m.		60 min.
RESPONSIBLE FOR REGISTRATION / POSITION:	Wilmer Livia / Machinist A		

Fig. 4. Application of the Maintenance record on the injection machine C.

Results. Upon completing the implementation of the improvement, the positive results of the proposed model are presented with the selected adjusted manufacturing tools and the planned maintenance for validation through the evaluation of the indicators of the production area of the company under study. See Table 3.

Table 3. Initial situation vs. Final situation

Indicator	Initial situation	Final situation	Variation
Index of CUp	60.70%	78.69%	17.99%
Index of setup time	0.00%	47.58%	47.58%
Index of uptime	81.71%	96.13%	14.42%

5 Conclusions

The proposed production model was applied in a plastics SME, which had a low capacity used compared to the standard for that sector. After analyzing the most relevant causes of the case study it was decided to apply 5S, SMED and Planned Maintenance. Finally, by implementing the model in the case study production area, the index of capacity used was increased production rate to 78.69%, i.e. production increased by approximately 18%, as the setup time rate increased 47.58% and the uptime rate increased by 14.42% by reducing setup hours and failure hours respectively.

The trainings for the implementation of the improvement proposal were developed in the most didactic and accessible way for the lean team, of which no resistance was gained from the change of the new culture implemented.

The lean manufacturing 5S tool was applied in the production area and in the spare parts warehouse, resulting in better order and cleanliness of environments, as well as providing key support implementation of SMED techniques and planned maintenance.

References

1. PlasticsEurope Productores de Materias Plásticas: Reporte de análisis de los plásticos europeos datos de producción, demanda y residuos. Obtenido de Plastics – the Facts 2018, 05 de 10 de 2019. https://www.plasticseurope.org/es
2. Tecnología del plástico: Encuesta de composición del mercado y gasto de capital de la industria de plásticos de América Latina. Obtenido de Tecnología del plástico (2014). http://www.plastico.com/sitio/imagenes-produccion/14/pdf/The-Latin-American-Plastics-Industry-Market-Trends-And-Buying-Intention-Survey-Gio.pdf
3. Kosieradzka, A.: Maturity model for production management. Procedia Eng. **182**, 342–349 (2017)
4. Sieckmann, F., Nguyen, H., Helm, R., Kohl, H.: Implementation of lean production systems in small and medium-sized pharmaceutical enterprises. Procedia Manuf. **21**, 814–821 (2018)
5. Belhadi, A., Touriki, F.E., El Fezazi, S.: A framework for effective implementation of lean production in small and medium-sized enterprises. J. Ind. Eng. Manag. **9**(3), 786–810 (2016). https://doi.org/10.3926/jiem.1907
6. Ames, V., Vásquez, W., Macassi, I., et al.: Proceedings of the LACCEI International Multiconference for Engineering, Education and Technology (2019)
7. Guillen, K., Umasi, K., Quispe, G., Raymundo, C.: LEAN model for optimizing plastic bag production in small and medium sized companies in the plastics sector. Int. J. Eng. Res. Technol. **11**(11), 1713–1734 (2018)
8. Bataineh, O., Al-Hawari, T., Alshraideh, H., Dalalah, D.: A sequential TPM-based scheme for improving production effectiveness presented with a case study. J. Qual. Maint. Eng. **25**, 144–161 (2019)
9. Irajpour, A., Fallahian-Najafabadi, A., Mahbod, M.A., Karimi, M.: A framework to determine the effectiveness of maintenance strategies lean thinking approach. Math. Probl. Eng. (2014). https://doi.org/10.1155/2014/132140
10. Bartz, T., Mairesse, J., Barth, A.: Improvement of industrial performance with TPM implementation. J. Qual. Maint. Eng. **20**, 2–19 (2013)

Agile Inventory Management Model Under a Digital Transformation Approach for Stockout Reduction in Chemical Industry's MSE

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Abstract. Through digital transformation, company processes that are, or could be, conducted manually are reduced; moreover, human tasks are automated when software-based processes are established. This paper analyzes the adoption of a digital transformation tool to manage inventory through the application of agile models, such as Just-In-Time, and the use of Enterprise Resource Planning (ERP), employing the Deming cycle method, as several unclear empiric processes exist for managing inventory and purchases. It also upholds that as defined processes are established and the companies exert higher control over inventory turnover and outflows, they could apply methods, such as demand forecasting, to avoid stockout, supply shortage, and inventory loss.

Keywords: Inventories · Digital transformation · Supply · Agile models

1 Introduction

The intermediate goods' industry covers a sector of highly diversified goods that are generally employed in value-adding transformation processes, thereby resulting in their exhaustion during such processes. These inputs or raw materials are designated to several international industries, especially in China and the U.S. Peru imports most intermediate goods from Asian countries and the U.S., comprising over 50% of consumer goods. At present, micro and small enterprises (MSEs) account for 93.9% of the commercial sector and fulfill a fundamental role in the Peruvian economic activity; however, according to a Peruvian trading company, MSEs growth is limited due to factors such as lack of training, lack of business management, and informal employment.

Furthermore, MSEs encounter a series of obstacles that jeopardize their long-term survival and development. Previous studies reveal that the death rate of small enterprises

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is higher in developing countries than in developed countries. In addition, small enterprises should design specific short- and long-term strategies to avoid death, because establishing a small enterprise is risky and the chance of survival past the five-year milestone is low.

These aspects exhibit the need to identify the different factors that affect chemical industry's MSE growth. Therefore, this study focuses on inventory levels and operating management within MSEs. Current literature indicates no sufficient efforts are been made in Peru to support MSE inventory levels and purchase management and that as these enterprises grow, their middle- and long-term survival may be threatened. This study highlights the use of agile digital transformation tools to help organizations assert higher inventory and process control to achieve greater profitability and optimize costs. Therefore, we suggest the adoption of a digital transformation tool such as ERP that is designed to streamline manual processes focused on the main operating processes handled by MSEs [1]. Through the application of a pilot plan in a Peruvian MSE that is engaged in the trade of chemical inputs, we validated the model since during the three months of the test, its margin grew by 10% and stockout declined by 35%, which were optimum results for the model proposed.

2 State of the Art

2.1 Agile Inventory Management Model in MSEs

Maturity models help organizations gain a competitive edge, such as cutting costs, raising quality, and reducing time to market. These models were proposed by several industry experts, such as Schweigert, who introduced the hierarchical modeling to map agile processes to maturity levels. Authors such as Leppänen state that agile models follow their own maturity models in a predictable and consistent development process. All these experts concur that modern strategies were developed as an agile paradigm, attracted much attention over the past few years, and are gaining momentum due to the combined benefits they offer, such as reduced development costs and better and faster production of quality products; thus, these tools are extremely useful in controlling inventory for trading MSEs. The study's authors believe that models can be proposed to help organizations keep a competitive edge to cut inventory costs and enhance product quality because following hierarchical maturity models regularly involve a predictable and consistent development process [2–6].

2.2 Digital Transformation of Inventory Management in MSEs

The digitized world poses new challenges to organizational innovation. Organizational innovation processes and results are limited, more permeable, and increasingly complex because they cross traditional industry limits; blur knowledge domains; and involve heterogeneous actors with several goals, abilities, and experience. For these aspects, the development of digital innovation consequently involves the collaboration between domains, i.e., collaborative work between persons with different experiences to align and integrate their specialized contributions to work together to achieve a common goal.

The authors agree that global competition accelerates the search for innovation. Besides, the increasing complexity of products and processes caused by digital transformation also prompted companies across the globe to meet their customers' needs. Moreover, product lifecycle management systems help companies control product lifecycle; consecutive versions of products; and parallel product lines of the initial concept and idea development phases for the subsequent design, engineering, manufacturing, and order processing activities [7–9].

3 Contribution

3.1 Overview

The models shown in Fig. 1 integrates information included in the inventory record, requests, and inflow of products and sales record to process it through an IT tool, which is designed through an ERP that calculates the virtual Kardex automatically, the average variable cost, and the sources of demand. This base is designed to inform about the supplier that offers the best price upon purchase.

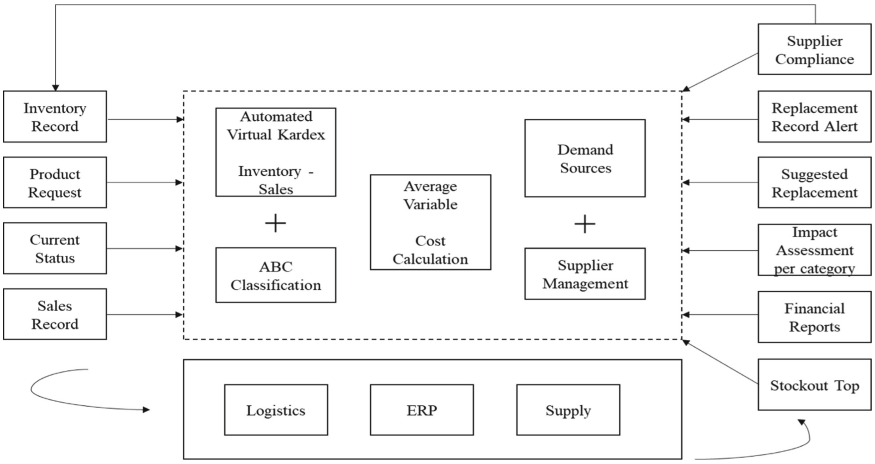

Fig. 1. Inventory management model overview

The aforementioned information generates the ERP so that the system may create automatic tables such as the replacement record alert to help the company place purchase orders automatically, the replacement suggestions on the basis of the minimum order unit per type of product, and impact assessments per category. This information is utilized by companies to analyze profitability per use or product category, depended on the case.

3.2 Detailed View

The following devices ensure the proper operation of the model:

ABC classification matrix: In the proposed table, the company should order products traded based on priority.
ABC layout: It prioritizes A-category products to exert greater control over them because they are the most valuable items for trading companies. Item layout in a blueprint or design will locate A-category products at the main location of the warehouse; furthermore, there will be a heat map at the warehouse entrance to identify each product's classification.
Demand forecasting table: This table is used to calculate demand forecasts to identify potential product requests and avoid stockouts
Lead time template: This template is used to include all products and supplier's replacement time in a single chart, considering that most raw materials are imported, and durations vary per supplier, country of import, and type of goods. The model considers the days spent by the supplier to process and prepare the order + transit time + decustoms time (arrival at the warehouse). This template is included in the purchase matrix. It will be the total time spent by the product from the moment the order is placed to its arrival at the warehouse.

3.3 Process View

As shown in Fig. 2, project is responsible of analyzing the company's operating processes, most of which are conducted manually, for automation and reporting purposes.

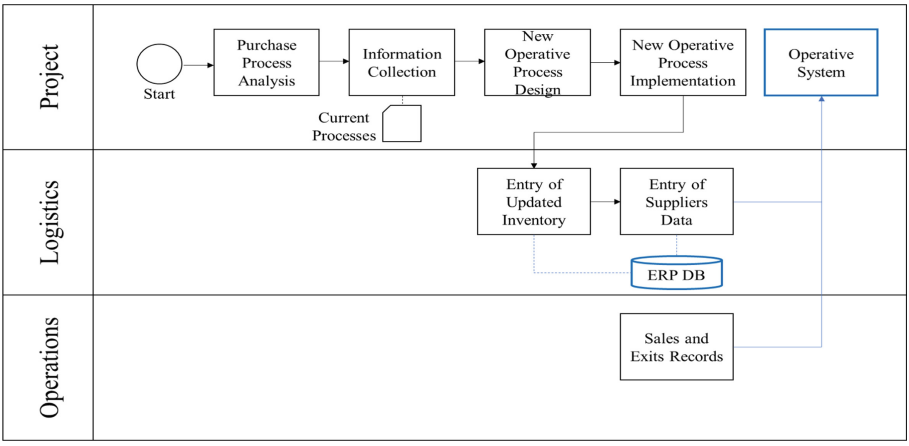

Fig. 2. Process overview

Logistics updates the ERP with purchase, supplier, and business-related data.

Sales will enter daily sales, shrinkages, and/or donations to the system so that these smart data may calculate purchase alert timely.

3.4 Indicators View

Inventory turnover rate. Purpose: To know inventory turnover in a warehouse during a period.

$$\text{Cost of product/Average stock.} \tag{1}$$

4 Validation

4.1 Inventory Turnover Rate

In 2019, a three-month pilot test was conducted in a Peruvian MSE engaged in the trade of chemical inputs. GARAMENDI and CIA S.R.L. engages in the import, trade, and distribution of chemical inputs. It began operating in 2000 and began employing the ERP pilot plan to control inventory and purchase management from July 2019.

$$\text{Turnover indicator} = 900/2{,}075 = 4.34. \tag{2}$$

This indicator shows that the company has a product ratio to supply for four periods; in conclusion, there is excess inventory, leading to greater storage and maintenance costs. The company's storage cost per kilo on a monthly basis stands at:

$$1{,}900/80{,}000 = 0{,}024. \tag{3}$$

4.2 Lead Time Indicator

This matrix shows the latency between the moment the purchase order is placed and the arrival at the warehouse (Table 1).

Table 1. Average lead time for each chemical product.

Component	Activity (days)			
	Order	Transit time	Customs	Total lead time
Potassium nitrate	15	32	10	57
Potassium chlorate	10	27	10	47
Magnesium	10	20	10	40
Perchlorate	15	32	10	57

Table 2. Yearly estimated value of lost sales due to stockout.

Product	Profit per kg (PEN)	Lost sales due to stockout per kg (PEN)	Total (PEN)	Number of stockouts per year	Total (PEN)
Aluminium	15.0	750.0	11,250.0	3.0	33,750.0
Potassium nitrate	2.3	5,000.0	11,750.0	2.0	23,500.0
Titanium	39.0	100.0	3,900.0	4.0	15,600.0
Total					**72,850.0**

4.3 Stockout Indicator

This indicator shows stockout per type of product in each period and the resulting loss for the company (Table 2).

First, product distribution was changed according to the ABC classification layout, and then, the product classification matrix was modified.

4.4 Product Classification Matrix

Products were classified into A, B, and C according to their importance for the company's sales to locate them based on such classification. Subsequently, the ERP tool was implemented to integrate the main processes conducted by MSEs, such as purchase, sale, warehouse, and distribution.

4.5 Results

The implementation of the pilot project reduced the company's stockout by 11% (Fig. 3).

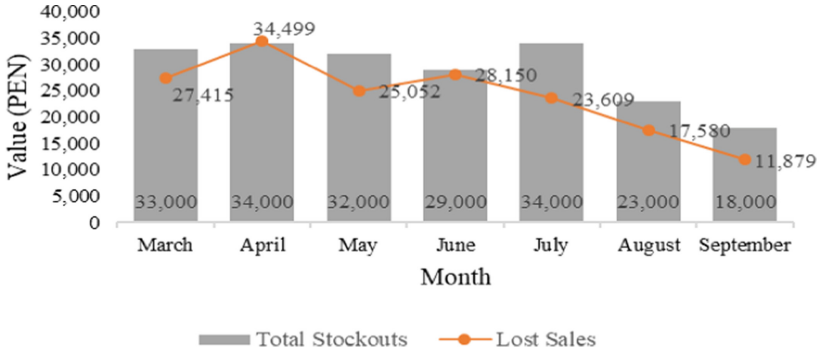

Fig. 3. Lost sales and stockouts monthly evolution.

5 Conclusion

This paper aims at gaining a better understanding of MSE inventory management by integrating digital innovation and agile tools in collaboration with experts to create a joint tool for formalizing MSE growth. Our findings contribute to the literature on the use of innovation and agile inventory management tools designed for a company with a low operating capacity.

Developing an ERP system on the basis of the central processes performed by chemical industry's MSEs is essential because its success will contribute to their maturity and growth in accordance with the regulations of the countries where they operate.

Feeding the ERP is a highly important process because it determines the information that will be processed and the analysis that will be generated. The different factors within a company that contribute to the proper operation of an integrated system such as the one proposed in this study are analyzed; however, it lacks depth in talent management based on human factor because the project is considered to involve a high technological burden in which personnel is essential for proper implementation.

It is considered a successful model due to its capacity to adjust to different market scenarios because MSEs in the Peruvian chemical industry still do not utilize IT tools to maintain an updated record of inventory levels, which is critical for growth and maturity because current regulations require the sales breakdown and monthly inventory record for certain chemicals.

References

1. Mohamed, A., Eman, N.: Beneficios Y Desafíos De Los Sistemas Erp En La Nube En Una Literatura Sistemática. Science Direct, Egipto (2016)
2. Schweitzer, F.M., Handrich, M.: Digital transformation in the new product development process: the role of it enabled PLM systems for relational, structural, and NPD performance. Int. J. Innov. Manag. **27**(7), 1950067 (2019)
3. Valdez-Juares, L.E., Solano-Rodriguez, O.J.: Learning modes and profitability in colombian and mexican SMEs. J. High Technol. Manag. Res. **29**(2), 193–203 (2018)
4. Wang, Y.: What are the biggest obstacles to the growth of SMEs in developing countries? An empirical evidence of a business survey. Borsa Istanbul Rev. **16**, 167–176 (2016)
5. Anupama, P.: Adopting PDCA (Plan-Do-Check-Act) cycle for energy optimization in energy-intensive SMEs. J. Clean. Prod. **145**, 277–293 (2017)
6. Chávez, J., Osorio, F., Altamirano, E., et al.: Lean production management model for SME waste reduction in the processed food sector in Peru. Adv. Intell. Syst. Comput. **2019**(971), 53–62 (2019). https://doi.org/10.1007/978-3-030-20494-5_5
7. Silva, A., Medeiros, C.: Cleaner production and PDCA cycle. J. Clean. Prod. **150**, 324–338 (2017)
8. Kong, L., Luo, H.: Sustainable performance of JIT management on time (JIT) in scheduling of batch delivery depending on the time of prefabricated construction. Int. J. Hum., Paises Bajos (2018)
9. Nambisan, S., Wright, M.: The digital transformation of innovation and entrepreneurship progress, challenges and key. Res. Policy **48**(8), 8103773 (2019)

Defining Organizational Capabilities in an Electric Power Distribution Grid Operator to Meet Future Demands

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Abstract. Electric power distribution grid operators (DSOs) are facing new requirements due to increased introduction of renewable energy, increased flexibility, and a tighter integration with customers. Although there is broad agreement that DSOs are at the heart of the transition towards decarbonized energy, there is little knowledge of what this means in terms of work system changes for the DSOs and how to approach the issue. In this paper, we present results from our work with defining and detailing organizational capabilities that enable the DSO to deliver in the future market. We find that the DSO need to professionalize its capabilities innovation, collaboration, analytics and influence because these are expected to face increasing demands. Using a participative approach as part of the re-design process was important to understand the resource development needs.

Keywords: Macroergonomics · Organizational capabilities · Work system design · Power distribution grid operator

1 Introduction

Electric power distribution grid operators (DSOs; Distribution System Operators) are expected to face new requirements due to increased introduction of renewable energy, increased efficiency, increased flexibility, and a tighter integration with customers [1]. This relates to a fully digitized future based on new technologies with cloud computing, internet of things and artificial intelligence. Production and consumption patterns are changing from large centralized generation of electric power and pure consumers to distributed generation and more complex consumers. As summed up by Vinghoets, Chebbo and Hatziagyriou [2], the power grid companies will have a central role in this development: "*As a first step, the current roll-out of smart meters and smart metering infrastructure in Europe will open up wide opportunities for connecting the smart homes, smart buildings and industry 4.0 with the energy grids*". Political goals enabled by new technology and digitalization are drivers that will dictate the future role and organization of power grid companies which, in turn, will need to effectively adapt in a fast-changing market. However, there is large uncertainty regarding the overall mechanisms that will

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be established in the energy system, and, subsequently, the internal reconfiguration that will be needed of the grid companies to meet the new demands [3].

Although there is broad agreement that DSOs are at the heart of the transition towards decarbonized energy, there is little knowledge of what this means in terms of work system changes for the DSOs and how to approach this issue. To close this knowledge gap, a three-year project with four Norwegian DSOs was established, one of which served as an in-depth case study. In this paper, we present results from our work with defining and detailing organizational capabilities that directly informs the organizational design and resource development that support the DSO in delivering in the future market.

2 Method

In the current study, we adapted an approach for identifying and defining organizational capabilities necessary for digitalization in the oil industry, the Capability Approach [4, 5]. Although several other macroergonomic methods exist, these did not seem fitting to the task at hand because they do not fully take into account the external environment and how that may disrupt the organization's existing way of working. The Capability Approach was developed for organizational (re-)design in such settings. It builds on the theoretical basis of dynamic capabilities [6–9] that is specifically concerned with how organizations maintain evolutionary fitness by responding to opportunities and threats in the business environment [10]. The approach is further operationalized within applied work system design and the field of macroergonomics [11, 12].

A capability refers to the combined capacity and ability to plan and execute in accordance with the targeted business objective(s) through a designed combination of people, processes, organization and technology [13]. Hence, the approach aims to design work systems, focusing on the configuration of resources that, combined, enable the delivery of targeted outcomes.

2.1 Identification of Capabilities

We first performed a contextual analysis in which we identified main drivers for transformation, how these are expected to impact on the DSO, and the organization's readiness to meet the future demands (see [14] for an elaboration). The analysis showed that in the present to mid-term perspective (i.e. 3–5 years), there are large known changes to their operations (e.g. increasingly data-driven decision making based on data from smart meters) as well as major uncertainties related to the electricity power grid ecosystem (i.e. regulatory changes to tariff schemes and market roles). However, the core business of the DSOs will remain the same. To deal with these uncertainties, we propose to develop organic capabilities that can support operational capabilities and be utilized in various situations that the DSO faces and across different functions in the organization. Four such capabilities were identified:

- Analytics - to extract, quality assure and consolidate data for utilization in decision making;

- Collaboration - to involve relevant expertise and authority at the right time in decision making regardless of organizational and geographical location
- Innovation - to identify and develop business opportunities and leverage new developments in the organization; and
- Influence - to change, develop and customize framework conditions to the identified business opportunities.

These four capabilities were modelled as a supporting layer in the organizational stack, referring to their supportive function for operational capabilities [14]. The next step in the Capability Approach is to further define and detail these capabilities, which is the main focus of this paper.

2.2 Defining and Detailing of Capabilities

When defining and detailing capabilities, we are essentially generating hypotheses of the capabilities' function and design. We used a case method as a basis for our work with the four support capabilities of the DSO. A single case may vary in complexity, referring to everything from a technical challenge to a more complex processual issue within the organization. The identification of potential cases was done in collaboration with the organization based on the following criteria:

- Addresses strategic objectives in the organization;
- Addresses an issue or exploit an opportunity in a division or in the interface of divisions in the organization;
- Can be completed within the project period;
- Is likely to result in implementable solutions.

A selection process was performed amongst the potential cases in which we first assessed the cases for their relevance to the four capabilities and categorized them accordingly. We decided on nine cases that we deemed sufficient to inform each capability and that, combined, involved most parts of the organization. The same case method was applied to all cases [15]: Situation analysis; description of future situation; and actions to achieve the future situation. Each case was ascribed a case owner (manager in the relevant department where the value creation will take place) and a case facilitator (employee with basic training as an internal change agent and with an interest in the case). The research team worked closely with case facilitators and our direct involvement in each case varied depending on the facilitator's capacity and experience.

Due to the variety of issues addressed in the cases, the number of iterations in each case varied. Similarly, different techniques for data collection were used including online questionnaires, interviews, focus group sessions, work process descriptions, and user testing. For example, a key case in informing the innovation capability was one that focused on managing R&D projects initiated by external organizations. We first had a work meeting in which the issue was presented by and discussed with the key stakeholders internally in the company. Then, a series of interviews were performed with individual employees who had experience with managing R&D projects and who held a key role (formal or informal) in coordinating R&D activities and participating in

R&D forums and industry networks. These individuals were subsequently invited to a half day workshop. In the workshop we first summarized and verified the description of the current work process, including key challenges in the different steps. Next, we analyzed why these key challenges arise. We then identified major improvement areas and, finally, we agreed upon key actions to be taken. The actions were, in turn, followed up and worked through in several iterations.

Cases were documented in accordance with the case method. The documented material was synthesized for each of the capabilities. We analyzed the material in terms of identifying the types of situations for use of each capability (i.e. hypotheses for deliveries in the organization), and common challenges and opportunities to achieve deliveries (i.e. hypotheses for resource development needs).

3 Results

Our analysis points to a need for the DSO to professionalize its capabilities in analytics, collaboration, innovation and influence. These capabilities will face increasing demands for deliveries, both internally in the organization and from other actors such as customers, municipalities, other DSOs and regulators. For the purpose of exemplifying, we will mainly rely on our work with the innovation capability in the remainder of this paper. The results from our case-based method in defining and detailing the innovation capability are provided in Table 1. This activity supported an analysis of the DSO's current practice and key issues to address in the design of the capabilities.

Table 1. Definition and detailing of the innovation capability

High level goal	To identify and develop business opportunities and leverage new developments in the organization
Situations for use	Continuous improvement, development projects, R&D with external partners
Specific goals	Streamlining of work processes, development and implementation of new tools, methods and/or processes; competence development and knowledge building for efficient task execution
Hypotheses for deliveries in the organization	Discover, interpret and pursue opportunities in the surroundings; transform information into knowledge; combine individual knowledge and utilize collectively in the organization; distribute tasks, resources and activity according to new capability configurations
Hypotheses for resource development needs	Resource capacity, structural measures for coordination, selection, development and follow-up of key roles, communication

The future demands point to faster pace of change, especially in terms of new technology. Therefore, the DSO needs to be able to detect and assess new opportunities, seize those that are deemed most applicable, and finally implement necessary changes. Although the organization is currently seen as one of the most innovative amongst the DSOs in Norway, the analysis revealed that it did not have necessary mechanisms in place for managing the increasingly faster pace of (external) changes as they already experienced difficulties in managing innovations. For example, in the R&D case briefly explained above, three main improvement areas were identified. The first was that the R&D activities were weakly anchored in the organization as it was not linked to business objectives and competence development needs. Because there was no clear strategy for leveraging R&D to benefit the organization, it was difficult to prioritize between project proposals and, for the employees who were put on the projects, to gain acceptance for spending time on those projects. Second, and associated with weak anchoring, there was no clear structure to managing R&D activities in the organization: There was no clear process for reviewing and prioritizing amongst project proposals, there was no mandate and role description for project managers internally in the company, and there was no arena for discussion of R&D needs, activities and potentials across disciplines. Other cases focused on the development of information- and visualization tools that leveraged the incoming datastream from smart metering as decision support. These provided further support for the conclusion that there was no established structure or mechanisms for prioritizing between innovation projects and allocating sufficient resources internally to deliver in these projects. This was sorely needed because there was scarce inhouse capacity to partake in the development processes of such projects and, particularly to facilitate the processes and to do the actual work.

Based on the work with defining and detailing the capabilities, we further specified hypotheses for resource development. For the innovation capability, these were:

- The ability to execute and implement innovations will be improved by strong prioritization amongst initiatives
- The capacity to innovate will be improved by establishing resource pools and emphasizing managers' role
- Organizational learning will be improved by facilitating the internal communication of innovation activities

By using the stack model framework, it was possible to identify potential resource developments that could meet the needs of more than one capability. For example, establishing a prioritization council with representatives from the various disciplines could meet the prioritization needs of both the innovation capability and the analytics capability. Similarly, further developing and strengthening the change agent competence as well as clarifying their role in the organization could be beneficial for innovation activities generally, as well as development and implementation of analytics tools and implementation of digital collaboration tools. The process of testing the hypotheses of resource development was subsequently performed, but is beyond the scope of this paper.

4 Re-design as a Change Process

Designing the work system of a DSO is no small task given that their current ways of working might not be appropriate for the future. The Capability Approach was decided on because it guides the formulation of a strategy for the work system re-design based on the changes in the environment in which the organization operates. As such, it can be seen as a top-down process to design. However, we based our definition and detailing of the capabilities on the needs of the people and disciplines in the organization and the new situations they anticipate. Hence, the further conceptualization of the capabilities was greatly informed bottom-up. This is consistent with what Auernhammer and Leifer [16] emphasize as important for designing organizations human-centered.

Holden et al. [17] argue that macroergonomic field research can itself be conceptualized as a change, and that organizational change management principles can be applied to achieve implementation goals of research. This is very much the case in the research described here. We find that the Capability Approach successfully allowed us to adhere to the macroergonomic field research framework proposed by [17]. The first metaprinciple of following a systems approach was met by not only focusing in on parts of the DSO system, but also understanding their interactions with each other and the external environment. The contextual analysis relates to the organizational level and the external environment in which the DSO operates. Whereas the cases allowed for analysis at lower-level units of analysis, within and between teams, as well as microergonomic issues related to human-computer interaction and competence development. Further, [17] propose a second principle that change is dynamic, and often involves iterations. The Capability Approach takes this into account and approaches the overall design task through several iterations, each attempting to increasingly specify the design. Third, [17] propose that macroergonomic field research is also about navigating politics associated with the change. Both the Capability Approach and our specific choice of applying a case method contribute in this respect by aligning the needs and goals of management with the needs and perspectives of employees and actively involving both in the design process.

Based on the analysis, specific measures for development of resources were designed and tested. In that conjunction, we performed several measurements in the organization to see if the organization experienced progress in terms of capability development. One such measurement was a simplistic test that targeted all four capabilities by using the company semiannual meeting as an easily accessible arena. By using the game-based learning platform Kahoot!'s survey mode, multiple choice questions were presented simultaneously for all meeting participants on a big screen. The meeting participants answered with their mobile phones using the Kahoot! app or by logging into the Kahoot! webpages. This measure was used as an indicator of how successful the project initiatives were in communicating and reaching the company employees and it was applied in the latter part of the project period. It became evident that as many as 60% of the employees had participated in innovation work sessions focused on the application of analytics in their daily work, more than 60% had started working with analytics dashboards, and more than 60% of the company's employees reported using video conference for collaboration with colleagues and external companies. Hence, using established forums and available

technology that is easy to use enabled us to simultaneously measure and communicate the development process to the organization.

We find that the choice of utilizing the Capability Approach and a case method in this complex organizational re-design effort was important for three main reasons: First, it ensured that the design proposals were based on an accurate understanding of different operational needs, thereby informing the design. Second, each case enabled us to create engagement and buy-in with different parts of the organization, and with both management and employees. Third, it facilitated delivery of implementable solutions to specific problems while also informing the greater research project. Together, this enabled us to link our design proposals to the DSO's everyday and future performance as well as delivering value to the organization throughout the project.

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References

1. Research Council of Norway: ENERGIX - Energy Research, Attachment to Work Programme 2013–2022 (2013). https://www.forskningsradet.no/servlet/Satellite?cid=1253986210903&pagename=VedleggPointer&target=_blank
2. Vinghoets, P., Chebbo, M., Hatziagyriou, N.: The Digital Energy System 4.0 (2016). https://www.etip-snet.eu/wp-content/uploads/2017/04/ETP-SG-Digital-Energy-System-4.0-2016.pdf
3. Reiten, E., Sørgard, L., Bjella, K.: Et bedre organisert strømnett (2014). https://www.regjeringen.no/globalassets/upload/oed/pdf_filer_2/rapport_et_bedre_organisert_stroemnett.pdf
4. Reegård, K., Drøivoldsmo, A., Rindahl, G., Fernandes, A.: Handbook - The Capability Approach to Integrated Operations. IFE/HR/F-2014/1604 (2014). http://www.iocenter.no/
5. Reegård, K., Rindahl, G., Drøivoldsmo, A.: Strengthening the HF/E value proposition: introducing the capability approach. Proc. Hum. Factors Ergon. Soc. Annu. Meet. **59**(1), 1192–1196 (2015)
6. Ambrosini, V., Bowman, C., Collier, N.: Dynamic capabilities: an exploration of how firms renew their resource base. Br. J. Manag. **20**(1), 9–24 (2009)
7. Grant, R.M.: Prospering in dynamically-competitive environments: organizational capability as knowledge integration. Organ. Sci. **7**(4), 375–387 (1996)
8. Helfat, C.E., Finkelstein, S., Mitchell, W., Peteraf, M.A., Singh, H., Teece, D.J., Winter, S.G.: Dynamic Capabilities: Understanding Strategic Change in Organizations. Blackwell, Oxford (2007)
9. Teece, D.J., Pisano, G.: The dynamic capabilities of firms: an introduction. Ind. Corp. Change **3**(3), 537–556 (1994)
10. Teece, D.J.: Dynamic capabilities as (workable) management systems theory. J. Manag. Organ. **24**(3), 359–368 (2018)
11. Hendrick, H.W., Kleiner, B.M. (eds.): Macroergonomics: Theory, Methods, and Applications. Lawrence Erlbaum, Mahway (2002)
12. Kleiner, B.M.: Macroergonomics: analysis and design of work systems. Appl. Ergon. **37**(1), 81–89 (2006)
13. Henderson, J., Hepsø, V., Mydland, Ø.: What is a capability platform approach to integrated operations? An introduction to key concepts. In: Rosendahl, T., Hepsø, V. (eds.) Integrated Operations in the Oil and Gas Industry: Sustainability and Capability Development. IGC Global, Hersey (2012)

14. Reegård, K., Drøivoldsmo, A., Farbrot, J.E., Hurlen, L., Bodal, T.: Drivers for transforming the power grid company. In: Broberg, O., Seim, R. (eds.) Proceedings of the 50th Nordic Ergonomics and Human Factors Society Conference (2019)
15. Hurlen, L., Farbrot, J.E., Drøivoldsmo, A., Reegård, K.: The power grid operator of the future: a case method for developing organizational capabilities required to successfully adapt in a fast-changing market. In: Beer, M., Zio, E. (eds.) Proceedings of the 29th European Safety and Reliability Conference (2019)
16. Auernhammer, J.M.K., Leifer, L.: Is organizational design a human-centered practice? In: Proceedings of the Design Society: International Conference on Engineering Design, vol. 1, no. 1, pp. 1205–1214. Cambridge University Press (2019)
17. Holden, R.J., Or, C.K.L., Alper, S.J., Rivera, A.J., Karsh, B.-T.: A change management framework for macroergonomic field research. Appl. Ergon. **39**, 459–474 (2008)

Quality Management Model Based on Lean Six Sigma for Reducing Returns of Defective Clothing Articles in SMEs from the Clothing Industry

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Abstract. Even though there is a high demand for clothing articles in the market, they do not meet quality standards. This can be appreciated after the clothes are washed and dried and the study revealed that over 20% of the items were returned each month. This occurs when the acquisition of raw materials is focused exclusively on the price. Thus, there are no requirements for compliance with any technical specifications that would enable the production process to be equipped with quality raw materials. Additionally, the absence of control over the quantity of consumables based on demand generates reprocessed inventory, thus damaging the fabric. Therefore, the proposed model was made through the Lean Six Sigma method to reduce waste and meet client requirements. The results were a decrease in returns by over 16.5% and an increase in productivity by 28.5%.

Keywords: Lean Six Sigma · Just in time · 5S · Clothing and manufacturing industry

1 Introduction

In Peru, the clothing industry is one of the main sources of employment, accounting for 463,000 jobs. Additionally, it generates over 7.4% of the country's GDP [1]. SMEs have the biggest stake in the business sector at 99.4%, with a high number of them concentrated geographically in La Victoria, where major conglomerate Gamarra is located. Gamarra is one of the Peruvians' favorite shopping areas for clothing, as it offers a wide range of designer products at low prices [1, 2]. Despite an increase of 12% in Gamarra's sales between the years 2016 and 2018, most businesses are facing financial difficulties [1]. According to the National Association of Industries (SNI), production in the clothing

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sector suffered a steep 4.3% drop in 2017 [1, 2]. This was substantiated by the Gamarra clothing SMEs themselves, who stated that their sales had dropped by 70%, and that they had to offer discounts of up to 40% on the original prices of their clothing. The reason for their losses is the influx of Chinese imports and the introduction of "fast fashion" brands in shopping centers [3].

Nevertheless, even though there is great demand in the country, Peruvians are not satisfied because quality standards are not being met. A study shows that the main factors considered at the time of acquiring or buying clothes are quality (47%) and price (22.4%) [2]. The requirements of clients change over time, thus increasing their demands and expectations. In view of this, Peruvian SMEs are under constant pressure from clients and competitors to make quality products at the lowest cost. However, both Chinese merchandise and fast fashion are of poor quality.

The study identified that the reasons for this effect are related to aspects ranging from the acquisition of the raw material to their handling during the final stages of the production process. Most SMEs buy their consumables on the basis of how reasonable the price is rather than how good the quality is, so as to avoid impact on sale prices. However, even if they were to consider quality the main criteria, the fabric suppliers themselves do not certify that they are delivering products that meet quality standards. Apart from producing their own products, suppliers also purchase their fabrics in other Chinese importing companies, which exists a 40% risk in the future show effects on the garments after washing Another factor that has an impact on the fabric is in the clothing's production process. By not taking into account the exact figures for production and demand, the surplus stock must be kept in a warehouse. This affects the fabric because there is lack of knowledge on how to store it and the specific care needed for each type of material. Furthermore, not levelling production creates an inventory of in-progress clothing articles. Thus, there is a higher risk that the fabric might show dimensional alterations and twisting.

In view of this analysis, it was decided that these poor conditions be reported to each company that had over 20% of merchandise returns on an average each month. These garments are considered a waste for SMEs because there is no way to fix them. Even if there was, they would not have enough time to carry out the process. Therefore, this leads to overhead costs, waste of time, and bad reputations for businesses. Consequently, it was proposed that a quality-management model based on the combination of the Lean Manufacturing and Six Sigma tools be applied in clothing SMEs, given that the authors conclude that they achieved a positive impact on waste reduction and customer satisfaction for meeting quality requirements.

2 State of the Art

2.1 Quality-Management Model in Clothing SMEs

Quality management (QM) practices are tools, techniques, and strategies of continuous improvement of quality, normally driven by the need to achieve customer satisfaction [4, 5]. Its implementation, however, requires the full engagement of all the members of the organization, including the top management, which is critical in making sure the

practices are implemented effectively in several aspects of the products, processes, and services [4, 6].

2.2 Lean Quality-Management Model in Clothing SMEs

Lean is one of the most powerful improvement approaches aimed at providing manufacturers with a new competitive advantage through the systematic identification and reduction of waste [6, 7]. This satisfies the customers' demands in the shortest possible time period. adding better quality at a lower cost. With proven success in large companies, Lean has become more attractive for many SMEs around the world, encouraging the introduction of said methodology to improve productivity and efficiency in companies. However, due to financial and resource limitations, as well as the time constrains that SMEs face, the application of all the Lean initiatives may not prove successful [6, 9].

2.3 Six Sigma Quality-Management Model in Clothing SMEs

The Six Sigma model is mainly a methodology of improving the capacity of commercial processes through the use of statistical methods to identify and reduce or eliminate process variations [9, 11]. Thus, it is useful in problem-solving and providing a valuable approach for measurement. With its statistical base and the correct use of methodologies, it can be helpful in improving the quality of both the product and the process [9, 11]. As a project-based management approach, the array of Six Sigma applications is also progressing from defect reductions in the processes, products, and services in an organization to becoming a business strategy aimed at achieving a better understanding of customers' requirements, as well as commercial productivity and financial performance [10, 12].

2.4 Lean Six Sigma (LSS) Quality-Management Model in Clothing SMEs

Many different approaches centered on the continuous improvement of products and the production processes have emerged, which are focused mainly on productivity increment and cost reduction. Among them, Lean Manufacturing and Six Sigma have been acknowledged as viable alternatives to improve processes and the product or services in this manner [13, 14]. These are complementary methodologies: Lean seeks to optimize processes by streamlining their workflow and eliminating waste while emphasizing speed and efficiency, while Six Sigma seeks to eliminate process variations to minimize defects, thus highlighting quality. Although different improvement approaches, they are still compatible, because they focus on customer satisfaction, emphasize a process-oriented view, and help reduce costs [13, 15]. This provides a positive financial impact on the company along with meeting customer's expectations [15].

3 Contribution

3.1 Quality-Management Model

In the model's proposal, the Lean Six Sigma methodology will be developed as its main approach with JIT and 5S techniques through the DMAIC model. As per the

study performed, this will be materialized through the acquisition of good quality fabric consumables which will not suffer great alterations after being washed and dried, which means that in case there is some dimensional alteration and/or twisting, the fabrics will stay within a certain level of tolerance which varies depending on the type of textile material. This will contribute to eliminating storage of fabric consumables and in-process clothing inventory which also have an impact on the clothing. Above all, in the sewing process, adding a piece that has been affected in any way would in turn impact the alignment of the garment. Furthermore, the VSM, Tack time, and Heijunka will serve as supporting tools to determine the exact quantity and time it takes to produce an order, thus eliminating idle times in production. Figure 1 shows the model focused on the textile and clothing industry.

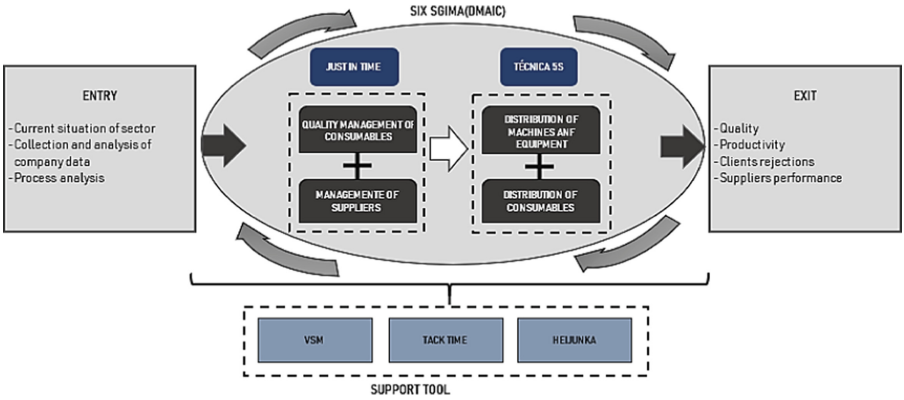

Fig. 1. Quality management model based on Lean Six Sigma

3.2 Implementation of the Model

One of the problems that cause the greatest financial impact on companies in the garment industry are the returns of garments due to defects in their fabric consumables. The type of textile material can be different in each company, as well as the production process. For this reason, the following workflow is proposed that allows a complete analysis of the company, from the collection of information to the implementation of the model. The contribution of this project will be the interaction of the manufacturing tools adjusted with the application of the DMAIC model (Fig. 2).

3.3 Quality and Production Indicators

To access the model's success, quality indicators, as well as productivity indicators will be used to determine the impact on the distribution of the new process of production (Table 1).

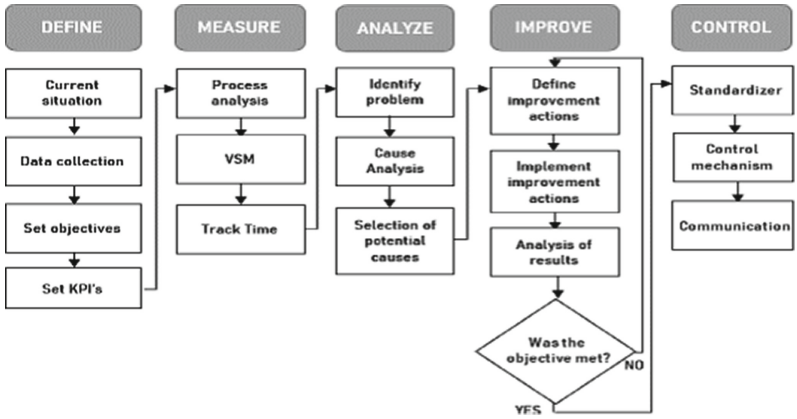

Fig. 2. Model implementation phases

Table 1. Quality and production indicators

Indicators	Description	Formula
Client rejections	Measures the amount of returns by clients	$\frac{\text{Resturned amount}}{\text{Total Sent}} \times 100$
Quality performance	Measures the volume of compliant products	$\frac{\text{Compliant products}}{\text{Total production}} \times 100$
Work-force productivity	Measures the contribution from the work force to the volume of compliant products	$\frac{\text{Compliant products}}{\text{M. H. Worked}}$

4 Validation

4.1 Just in Time

(1) Development of supplier selection criteria: The criteria of SME buyers located in Gamarra were taken into account so as not to affect their unit costs. Table 2 shows their respective ranges. In this case, the type of material is cotton and its tolerance is $\pm 5\%$.

Table 2. Development of supplier selection criteria

Criteria	Range
Quality	$5\% > x > -5\%$
Price	12.5 soles $>$ x
Flexibility	3 colors $>$ x
Availability	60 m $>$ x $>$ 50 m
Delivery time	2 days $>$ x

(2) Measurement of input quality: for this, the Lockuán method will be applied [16], and comparisons will be made for each company that offers the same fabric design (Table 3). It should be noted that washing and drying are not performed for each sample separately but rather all together.

Table 3. Measurement of quality of inputs

Quality-measurement results	Dimensional alteration		Twisting
	Wide	Long	
Company 1	−6%	−4%	−2%
Company 2	2%	−2%	4%
Company 3	−2%	−4%	2%

(3) Supplier evaluation: Once the companies outside of the tolerance range for each color are discarded, the service from the suppliers is then evaluated with its pertinent criteria and deliberation, shown in Table 4. Finally, the one with the highest score is chosen, which would be Company 2 on color 1.

Table 4. Supplier evaluation

	%	Comp. 2	Result	Comp. 3	Result
Quality	35%	4	1.4	3	1.05
Price	25%	3	0.75	4	1
Flexibility	20%	5	1	3	0.6
Availability	15%	3	0.45	3	0.45
Delivery time	5%	5	0.25	5	0.25
Total		–	3.85	–	3.35

(4) Supplier performance measurement: The measurement will be based on the failures of the batches of fabric over the total received. The result should not be less than 90%, as it would increase your costs. In addition, there is no return or resize of the defective fabric.

4.2 Results

After applying the proposed tools of the model in the production area, the Table 5 shows the results obtained. Given the increase in productivity as an effect, it increased its sales without altering its costs as a result, it increased approximately 10% in its profitability compared to the months of October to December of the years 2018 and 2019.

Table 5. Current and achieved indicators

Indicator	Before	After
Client rejections	20.97%	4.4%
Quality performance	79.03%	95.5%
Work-force productivity	22.23%	26.10%

5 Conclusions

The model was successful in reducing returns by eliminating twisting and dimensional alteration defects that were taking place after washing and drying the garment. This was therefore reduced to 4.4%, showing a 95.4% increase in quality performance. Furthermore, the model had a positive impact on the search for materials and reduction of transportation time (86%) resulting in a reduction of 28.5% in the production cycle time. Increase in production capacity and quality assurance of their products permitted a positive impact of 13.99% on sales between October and December 2019. It also resulted in costs savings of 9.33%, thereby increasing profitability.

References

1. Ministerio de la Producción: Industria de Textil y Confecciones: Estudio de investigación sectorial. Lima (2015)
2. INEI: Características de las Empresas del Emporio Comercial de Gamarra. Lima (2016)
3. Plus Empresarial: Grave situación de Gamarra preocupa a empresarios. ¿Qué sucede? (2016)
4. Chakraborty, A., et al.: Quality management practices in SMEs: a comparative study between India and Namibia. Benchmark. Int. J. **26**(1499–1516), 5 (2019)
5. Sukwadi, R.: The implementation of quality management practices in Indonesian SMEs. Int. J. Trade Global Mark. **8**(3), 207–222 (2015)
6. Cortez, C., Di Laura, N., Viacava, G., Raymundo, C., Dominguez, F.: Lean manufacturing model based on knowledge management to increase compliance in the production process in peruvian SMEs in the textile garment sector (2020). https://doi.org/10.1007/978-3-030-20154-8_10
7. Panwar, A.J.: Lean implementation in Indian process industries – some empirical evidence. J. Manuf. Technol. Manag. **26**(1), 131–160 (2015)
8. Soundararajan, K., Janardhan, K.: Cost-reduction and quality improvement using DMAIC in the SMEs. Int. J. Product. Perform. Manag. **68**(8), 1528–1540 (2019)
9. Psomas, E., et al.: Assessing Lean adoption in food SMEs: evidence from Greece. Int. J. Qual. Reliab. Manag. **35**(1), 64–81 (2018)
10. Yadav, N., et al.: Application of Six Sigma to minimize the defects in glass manufacturing industry. J. Adv. Manag. Res. **16**(4), 594–624 (2019)
11. Desai, D., Prajapati, B.: Competitive advantage through Six Sigma at plastic injection molded parts manufacturing unit. Int. J. Lean Six Sigma **8**(4), 411–435 (2017)
12. Ambekar, S., Hudnurka, M.: Factorial structure for Six Sigma project barriers in Indian manufacturing and service industries. TQM J. **29**(5), 744–759 (2017)
13. Lande, M., et al.: Critical success factors for Lean Six Sigma in SMEs. TQM J. **28**(613–635), 4 (2016)

14. Raja, V.Y., Raju, R.: A systematic literature review of Lean Six Sigma in different industries. Int. J. Lean Six Sigma **7**(4), 430–466 (2016)
15. Adikorley, R., et al.: Lean Six Sigma applications in the textile industry: a case study. Int. J. Lean Six Sigma **8**(2), 210–224 (2017)
16. Lockuán, F.: La industria textil y su control de calidad: Ennoblecimiento textil. Lima (2012)

Purchasing and Quality Management Lean Manufacturing Model for the Optimization of Delivery Times in SMEs in the Food Sector

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Abstract. This research focuses on a proposal to improve the purchase and supply processes for the food sector. An appropriate model for procurement management and monitoring is established. It is then validated that an adequate input purchase process reduces costs and improves the service quality of companies, which reduces delivery times to provide satisfactory service. Lean manufacturing tools, such as Value Stream Mapping (VSM), were applied to carry out the initial diagnosis of the process, activity analysis, and time measurements. Finally, the new process was standardized, and continuous improvement was achieved by applying purchasing management techniques. The research was experimental, and a pilot test was carried out in a company in the food sector. The results show that with the implementation of the new procedures, this company reduced the percentage of late deliveries, improved its service level and therefore its position in the industry.

Keywords: Purchasing · Logistics · Lean manufacturing · Supply chain · Risk management

1 Introduction

We currently live in a world where companies are constantly innovating. To be competitive, they seek to reduce processes and operation time to maximize profits and minimize production costs and expenses and boost productivity and customer demand. This is especially the case in the service sector, which aims to improve performance and customer development. In every company, as is known, the procurement department or area is of great importance, because it is the main manager of cost reduction of goods and/or services that the company may acquire [1]. In addition, twenty-first century purchases are becoming a multifunctional business process. This evolution has important implications for research because it requires an interdisciplinary management approach, including

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the integration of strategic purchasing, decision-making, and marketing, as well as the transformation of purchasing as integrated supply chain management [2]. According to the economic report of Lima´s Chamber of Commerce (2017), the promotion of the service sector is one of the driving forces of the Peruvian economy, as it employs over 6.5 million people. The good news is that it grows year after year, while the bad news is that informality in the sector has reached 58.5% [3]. By 2017, Peru showed an employed EAP of 16.5 million, and it is estimated that around 6,546,200 workers were employed in the service sector, which represents a 3.6% increase in employment, the highest rate in the last seven years (INEI 2018). In its most recent information, the INEI (Peruvian Institute of Statistics and IT) (2018) reported that the country's service sector grew by 3.44% over the same month last year [3].

This study seeks to analyze the application of lean manufacturing in a food service company, because it´s principles and techniques have been widely used by manufacturing organizations to gain a competitive advantage over their rivals [4]. It is also used as a manufacturing management approach that strives to make organizations more competitive in the market by increasing efficiency and lowering costs through the elimination of non-value-added activities and inefficient processes [4].

This improvement goes hand in hand with supplier management for the implementation of advanced purchasing practices such as supplier control, supplier participation in product design, supplier participation in production, or logistics integration that significantly contribute to an improved performance in aspects such as quality, flexibility, or reliability of the supply chain [2]. Purchasing integration with suppliers improves the performance of supply chain network readiness [5].

2 State of the Art

2.1 Lean Manufacturing in the Food Service Sector

Today's market is increasingly competitive worldwide, and organizations are under immense pressure to achieve operational excellence and improve their performance to reduce costs and deliver higher quality products in shorter time frames. The principles and techniques of lean manufacturing have been widely used by manufacturing organizations to achieve these goals and gain a competitive advantage over their competitors [4, 6, 7]. The Lean methodology is considered a successful method to improve the performance and competitiveness of an organization in the food industry [7, 8].

2.2 Purchasing Management in the Service Sector

Purchasing management today entails the integration of all supply chain operations. According to research, there is a positive relation between the implementation of advanced purchases and their performance, as well as the importance of the supplier's participation in the process [1, 2].

2.3 Standardization of the Purchasing Process in the Food Sector

In general, process standardization has a positive influence in the development of a company. For this reason, previous studies show that regardless of the sector to which the companies analyzed belong, all those that have standardized processes have a greater competitive advantage over direct competitors lacking the same or a better level of standardization in their processes [9].

2.4 Risk Management in Companies of the Food Sector

Research has shown that both manufacturing and service companies currently need to develop the use of risk management (RM) practices, because current companies need to present greater competitive advantages, which is why supply chain management is important and necessary to identify critical success factors [10, 11].

3 Contribution

The model proposed is a redesign of the standardized purchasing process for procurement and supplier monitoring. A modification to the current purchasing procedure will be made, and new documentation to follow up purchases will be created (Fig. 1).

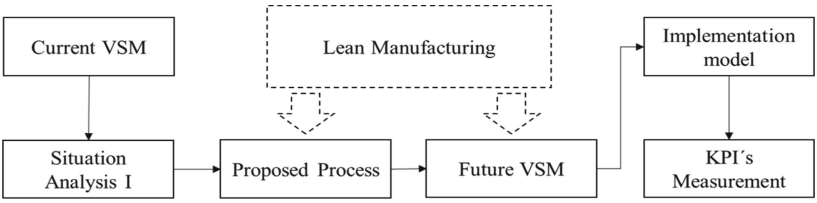

Fig. 1. Process improvement procedure

3.1 Design Overview

The first phase comprises the analysis of the current situation applying VSM to identify the processes that need to be improved. Then, an activity-based analysis of each process is carried out identifying those that add and do not add value, and time is measured. The second phase comprises the proposal that is made as a result of the analysis carried out using the principles of good purchasing management practices. Finally, the third phase comprises the validation of the proposed model through the implementation of a pilot test in a major company in the food sector.

3.2 Process Overview

It is proposed to redesign the standardized purchasing process for procurement and follow-up of purchases from the supplier.

During the standardization of a process, it is essential to take into account all parties involved and to analyze in detail each of the activities they carry out, as the aim of standardization is to find the most logical sequence, in order to keep the task as simple as possible by eliminating unnecessary activities. The steps for standardization are as follows:

- Involve operational staff.
- Investigate and determine the best way to achieve the process goal.
- Document with photos, diagrams, and brief descriptions.
- Train staff.
- Formally implement the standard.
- Review results periodically.
- Compare the results with the standard and take corrective action if necessary.

In the purchasing procedure, the goal, the responsible party, and the scope of the process are specified. To draft this document, the Company's Purchase Policy and the Procedure for Supplier Selection, Evaluation and Approval were consulted. Also, the basic conditions of the process are defined, incorporating guidelines to be executed in order to reduce any reprocessing due to miscalculations in the quantity to be ordered. For example, the quantity of the requirement to be negotiated with the supplier must be approved by a person responsible for the supply area, thus preventing any differences between the quantity to be ordered that was negotiated by Procurement and the final quantity generated in the purchase order by the person responsible for supply. Finally, all activities from the internal customer request to the delivery of the order by the supplier are specified.

3.3 Purchases Follow-up Procedure

This document describes the way purchases follow-up should be done, as it impacts the final product acquired. The scope of the procedure includes all stages, from the issuance of the purchase order request to the moment the supplier supplies the order at the company's distribution center (Fig. 2).

4 Validation

To validate the process, a pilot test was carried out in a company providing food services in the city of Lima, as well as in surrounding the provinces. To such end, the parties involved in the process were trained, and a work plan was defined:

- Identify the team by the person or team in charge of the pilot test
- Integrate the designated team and define duties according to new procedures

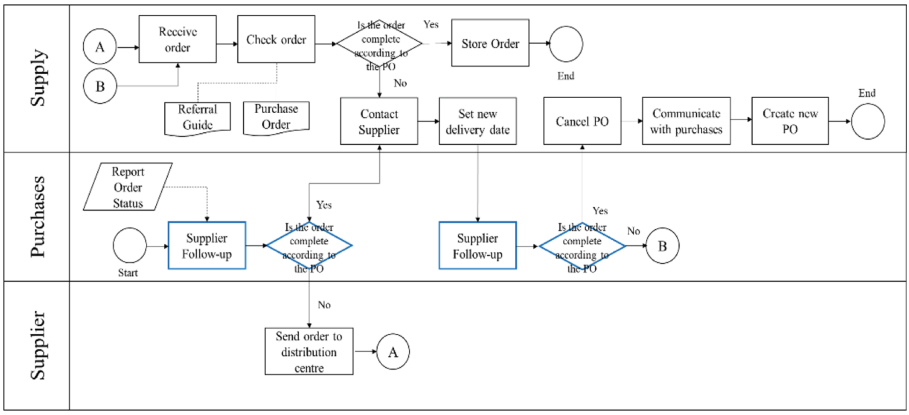

Fig. 2. Supplier follow-up procedure

- Train the staff in the new procedures to be followed
- Develop a validation plan, timeline and the assigned managers
- Implement the new model
- Evaluate results obtained with the new procedure
- Compare results and propose strategies for continuous improvement.

4.1 Results Analysis

After the two-week pilot test, results recorded in the system were downloaded upon implementation of the new procedures. The results obtained in this period by applying the proposed procedures and follow-up activities are shown in Table 1.

Table 1. Results analysis

Concept	Initial situation	Expected results	Actual results
Late deliveries	35%	10%	14%
Supplier compliance	68%	90%	86%

The previous table shows that late deliveries, after the new procedures were implemented, were reduced to 14%, down by 21% compared with the initial situation of the delivery problems. Although it is true that the initial 10% target was not achieved, the proposed methodology is validated since it is undergoing a period of stabilization because the period analyzed is still very short.

4.2 Financial Evaluation

Three tools were analyzed: cash flow, NPV criteria, and cost-benefit analysis. Their concepts, advantages, and disadvantages were evaluated in order to choose the most appropriate tool for this project.

As a result of the evaluation, it was found that the cost-benefit analysis is the most adequate for this project. Because it consists of an improvement in procedures, only an investment in personnel training is necessary, and therefore, a simple and precise analysis must be carried out.

The proposal—an improvement to the company's current procedures—does not involve an investment beyond training those processes owners. In this case, the Company's cost of personnel training hours was calculated and shown in Table 2 and 3.

Table 2. Total overtime cost calculation

Concept	Cost
Basic salary	PEN 3,000.00
Family allowance	PEN 93.00
Company cost	PEN 4,175.55
Hours/month	240
Cost/hour	PEN 17.40
Total overtime cost (x35%)	**PEN 23.49**

Table 3. Total training cost calculation

Concept	Quantity
Time (hours)	2
Days	5
Collaborators to be trained	3
Cost (hr.)	PEN 23.49
Total training cost	**PEN 704.62**

The previous table shows that the only investment the company will make is training its personnel on the new procedures. Considering that there are three employees to be trained over a five-day period, the investment amounts to a total of PEN 704.62.

Then, a cost-benefit analysis was performed, which shows that the project's NPV is PEN 908,134 per month. Thus, it is concluded that the project is financially viable, representing significant savings for the company on a monthly basis.

4.3 Impact Evaluation

Three methodologies were analyzed to carry out the impact assessment: the logical framework matrix, the Leopold matrix, and the hazard identification and risk analysis (HIRA) matrix. After analyzing the concepts, goals, and applications, the HIRA matrix was considered the best methodology to evaluate other impacts caused by the project.

Table 4. Risk identification

Stakeholders	Hazards	Description
Workers	Resistance to Change	Income Variation
	Psychological Mistreatment	Work Environment
	Work Overload	Skill, Knowledge and Development
Suppliers	Resistance to Change	They do not Adapt to new Procedures
	Lack of Communication	No changes are Reported during follow-up
	Lack of Training	Lack of Supplier Training
Clients	Economic	Attention in the Operation Services

In order to carry out the HIRA matrix, stakeholders must be defined together with the hazard associated with each one as shown in Table 4.

The HIRA matrix revealed that the work environment and resistance to change on the part of the managers are important risks in the development and fulfillment of the project. The action plan to mitigate these risks are the following:

- Psychosocial monitoring: Coaching classes to reduce change resistance.
- Training: Personnel will be trained so that change does not lead to problems in the performance of their activities.
- Stress management training: Psychological training will be provided in order to manage the stress caused by changes.

5 Conclusion

Results suggest the implementation of a purchasing management model applying lean manufacturing and supported by risk management reduces late deliveries and company costs, enhancing its performance and competitiveness by improving its services.

References

1. Rodríguez-escobar, J.A., González-benito, J.: The effect of strategic alignment on purchasing management. Manag. Res. Rev. **40**(11), 1175–1200 (2017)
2. Mogre, R., Lindgreen, A., Hingley, M.: Tracing the evolution of purchasing research: future trends and directions for purchasing practices. J. Bus. Ind. Mark (2016/2017)
3. Francisco, E., Aponte, C.: Encuesta mensual del sector servicios. INEI, pp. 1–14 (2019)
4. Taylor, P., Belekoukias, I., Garza-reyes, J.A., Kumar, V.: The impact of lean methods and tools on the operational performance of manufacturing organisations. Int. J. Prod. Res. 37–41 (2014)
5. Handfield, R.B., Cousins, P.D., Lawson, B., Petersen, K.J.: How can supply management really improve performance? A knowledge-based model of alignment capabilities. J. Supply Chain Manag. 3–18 (2015)

6. Borges Lopes, R., Freitas, F., Sousa, I.: Application of lean manufacturing tools in the food and beverage industries. J. Technol. Manag. Innov. **10**(3), 120–130 (2015)
7. Nallusamy, S.: Lean manufacturing implementation in a gear shaft manufacturing company lean manufacturing implementation in a gear shaft manufacturing company using value stream mapping. Int. J. Eng. Res. Afric (2016)
8. Kuzaiman, N.A., Zainuddin, A., Azlina, N.: Green lean TQM islamic process management practices in Malaysian food companies. J. Mech. Eng. **5**(6), 167–177 (2018)
9. Arias Ralvarez Mquispe, G., et al.: Modelo de interrelación basado en S&OP para pequeñas y medianas empresas del sector alimentario. CISCI 2018 - Decima Septima Conferencia Iberoamericana en Sistemas, Cibernetica e Informatica, Decimo Quinto Simposium Iberoamericano en Educacion, Cibernetica e Informatica, SIECI 2018, vol. 1, pp. 37–39 (2018)
10. Dora, M., van Goubergen, D., Kumar, M., Molnar, A., Gellynck, X.: Application of lean practices in small and medium-sized food enterprises. Br. Food J. **116**(1), 125–141 (2014)
11. Shah, S.R., Naghi Ganji, E.: Lean production and supply chain innovation in baked foods supplier to improve performance. Br. Food J. **119**(11), 2421–2447 (2017)

Data and Analysis

Analysis of Reading Offers: The Case of Finland and Germany

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Abstract. Submitting offers is part of the daily routine in sales and one important question is what gets read of such offers and where is attention oriented. We used eye tracking for testing a one-page quotation on a technical product. It seems that Germans and Finns have a similar pattern of attention and fixated on all relevant aspects of the offer, while Germans did not pay as much attention to pricing details and terms and conditions, and did not fixate as often as the Finnish participants. Finnish participants took more time reading the examples and had slightly more difficulty understanding the information.

Keywords: Eye tracking · Reading patterns · Sales offer · Human factors

1 Introduction

In sales, the submission of offers, quotes, and business proposals form part of the daily routine. There are many books on how to write a business proposal, although it is not known how they are actually read.

The range and design of the submitted offer depend upon the technical product's complexity [1]. However, each of the proposals is divided into different sections that follow a common structure. These may take the form of a header, a section with general information, and commercial and technical parts [2]. The information must be clear for the implicit message to meet the expectations of the relevant target group. Layout and typography have a huge impact on the reactions of buyers and decision makers [3].

The pricing information and delivery terms are frequently the focus; therefore, they should be placed in the main area of the proposal. Consequently, trust develops and makes the offer more appealing. The overview of the pricing and the presentation of the technical details need to be structured in the same way. Thus, numbering may be useful. The quantity and important technical and commercial conditions, in addition to the essential parameters that affect the offer's attractiveness, should be related to the offer price [4]. The layout design ideally should be based upon industry standards (e.g.

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the VDI 4504) and visual design rules. The psychological functioning of colors, bold text, bullet points etc. can be employed, although they are not as common in a B2B context [5].

Here we have used the term "offer" to refer to a legally binding document that states prices and deliverables in a condensed manner, usually after establishing a business connection (also known as quotations).

The capability of knowing what the addressee actually paid attention to and how deeply information was cognitively processed might provide valuable insights for sales-people to adjust their offers accordingly. Thus, the guiding research question for this study is: "What gets read of offers and where is attention oriented?"

2 Methodology

Humans must move their eyes (to be more precise, their fovea) toward the source of the information they want to grasp. The move to the focus area is called a saccade, and the time an eye stays focused on a certain region is called a fixation. Fixations show when the eyes remain on a position for a certain time after placing the fovea on the center of attention to see clearly what is displayed. During this fixation, it is assumed that humans are able to take in information, while during saccades this is generally not the case [6]. The assumption that humans only take in what is fixated upon is called the eye-mind hypothesis [7]. This is the central theoretical basis for most eye-tracking studies, assuming that humans "process the visual information we are currently looking at" [8] (Fig. 1).

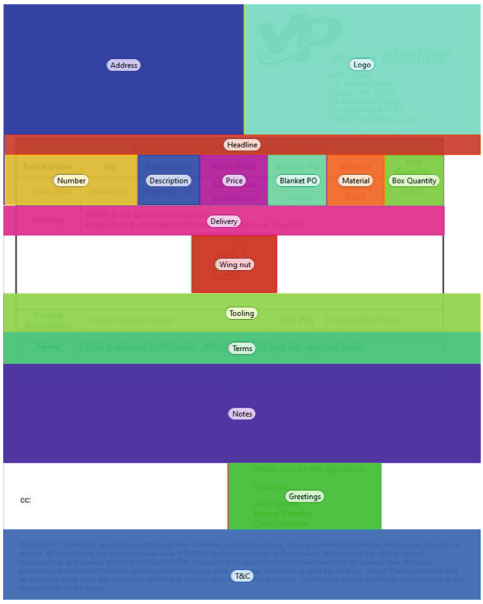

Fig. 1. Areas of interest for the example.

We used an example from an existing company, offering a technical product in English (readability from the Flesch Ease Score [9] categorized the example as "difficult to read," which is typical for such documents). This example was divided into so-called areas of interest (AOI) around important regions of the document. This allows the analysis of patterns of reading and comparative analyses. These AOI are visible in figure one.

We had a sample size of 73, of which 35 participants were from Finland and 38 from Germany. The mean age of the correspondents from Finland was 32.1, the percentage of women was 31.4%, and 60% of the Finnish participants were engineers. The mean age of the respondents from Germany was 31.5, 23.6% were women and 27 (69.2%) of the German participants were engineers. Of the 73 correspondents, 58.3% had more than three years of work experience (FIN: 55.9%, GER: 61.5%).

Participants were mainly bachelor's or master's degree students, who were recruited on campuses in Finland and Germany. Participants were briefed, answered some demographic questions, and placed in front of the eye tracker. A five-point calibration process was conducted and assessed by the instructor before the actual examples were shown on a laptop screen. The eye movements then were recorded with an eye tracker attached below the 17-inch screen (Tobii X3-120). After recording, we asked participants additional questions on the quality of the examples, their experiences with reading offers, and so on. After debriefing they were given some sweets as compensation.

For quality assurance, all records were deleted if calibration was not successful, if they had recording gaps longer than 3 s, or if the overall usable gaze data (recorded eye movements) were below 70% for the entire recording (including the instruction pages). For the analysis of the fixation durations, a threshold of 75 ms was chosen to discard short fixations. For the fixation counts 200 ms was chosen to make sure fixations were long enough to allow taking in of information [10]. For data analysis and visualization, Tobii Studio Pro 3.4.8, JASP 0.11.1, and SPSS 21 were used.

3 Results

The results showed that the Finnish participants spent more time with the offer than the German participants (94.3 s vs. 79.4 s), measured as total visit duration (TVD). Both groups directed around the same amount of time—approximately 95%—to relevant information (classified beforehand, such as price, quantity, terms, etc.) and only 5% on nonrelevant information, such as the logo or other kinds of information. Both groups also spent around 4% of their time on the price information region.

A heat map based on the attention of participants (measured as fixation durations) shows much commonality, as can be taken from figure two. We can also see that Germans and Finns had similar **attention patterns** and fixated on all relevant aspects of the offer, with the exception that Germans did no pay as much attention to pricing details and terms and conditions. The figure in the middle did not gain much attention compared to the details section, indicating that participants focused on reading more (Fig. 2).

The sum of all fixations (the time when information can be taken in) showed that Germans took 69.1 s for fixations, while Finns took 80.7 s to fixate, which was not a significant difference ($r_B = -.16$).

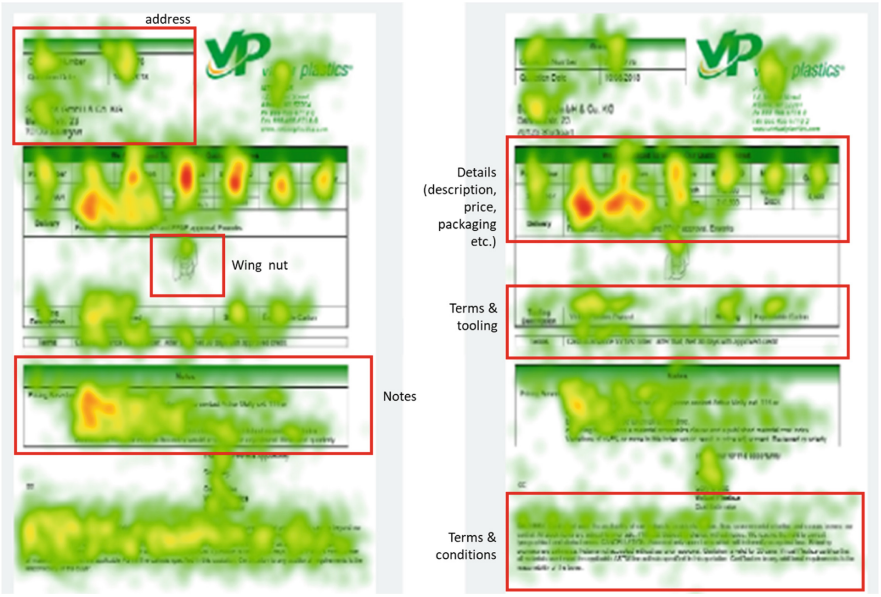

Fig. 2. Heat maps for the offer (left Finnish participants, right German participants).

German participants spent 7.6% of their time on searching (Finnish participants 8.7%), highlighting a significant difference ($U = 796$; $p = .028$), with a medium effect size ($r_B = .26$), indicating more difficulty in understanding for the Finnish participants.

We also used the number of fixations longer than 200 ms as a proxy for **difficulty of understanding** [1] and found that based on this metric the Finnish participants had more difficulty reading it (161.9 fixations on average) than the German participants (135.6 fixations on average)—not a significant difference ($U = 512.5$; $p = .089$ one-sided), with a small effect size ($r_B = -.19$).

3.1 Additional Analysis

In addition to studying cultural differences, we investigated the effect of gender and field of education and asked questions regarding the understanding of the examples (knowledge-related, e.g., "how much does one piece cost?"). We then asked for a subjective evaluation of the two examples regarding the overall quality, layout, understanding of the text and the (again self-assessed) cognitive demands when working with the examples (all on a seven-point Likert scale).

The self-assessment data was consistent; participants with a higher self-assessed ability to understand English had higher scores ($r_S = .210$; $p = .051$) and lower cognitive demand in answering the questions ($r_S = -.216$; p = .034 one-tailed). These self-assessments had only weak correlations with eye metrics: The individual assessment of the cognitive demand of the two examples was only weakly associated with the number of fixations as an indicator of difficulty ($r_S = -.166$) or the sum of all fixations ($r_S = -164$), which would indicate a deeper processing of information.

We also compared two groups, based on a median split: those with a higher score (the sum of correct answers, ranging from zero to three) and lower scores. There was a significant difference between these two groups related to the numbers of fixations on target areas ($U = 377.5.0$; $p = 0.005$) with a larger effect size ($r_{\mathrm{B}} = -.36$) and the attention given to price details ($U = 455.5$; $p = .051$, medium effect size $r_B = -.23$). It appears that those who were more likely to give the right answers also paid more attention to the relevant areas.

In this study, we did not find an effect of the field of education on eye metrics or other variables, such as the number of correct answers. Similar results were obtained for the effect of gender.

4 Conclusion

This study did reveal some differences in how offers were read by Finnish and German participants. Finnish participants took more time reading the examples and had slightly higher difficulties processing the information, although with small or medium effect sizes. They also needed more time searching for information.

We could see that some graphical elements like lists and headers caught the attention of the readers. At the same time, figures and pictures in the proposal example did not get much attention. This could indicate that participants actually focused on reading and processing the information because they were told they would be asked to answer questions on the content later. The self-assessed higher ability to understand English actually was related to a deeper understanding of information and lower cognitive demand, which is intuitive.

We found no connection between the field of education or gender and the eye metrics or other variables, such as the number of correct answers.

These are the first results obtained for analyzing such offers with the help of eye tracking and it is therefore clear that the study has some limitations. The empirical basis for reading such offers is not well developed to guide researchers, although many references to reading graphs or reading studies exist [e.g., 8, 10]. We also only had a small sample size from both countries and a one-page offer to test. Future research, therefore, should analyze longer offers or proposals and perhaps technical documents and strive for larger samples. In addition, it would be interesting to compare different cultures or to compare the results for this English example with examples written in the respective local language. From a methodological standpoint, it could also be helpful to dive deeper into the analysis by looking for search patterns or additional eye metrics, for example, with the help of visual analytics.

References

1. Friedmann, D., Laduc, L.M., Lawrence, H., Sharon Desmond, S., Porto, E.: Inside Business Writing. Kendall Hunt Publishing, Dubuque Iowa (2009)
2. VDI 4504 (Part I): Offer Management in the Industrial Goods Business (2010)
3. Johnson, J.S., Friend, S.B., Malshe, A.: Mixed interpretations of sales proposal signals. J. Pers. Selling Sales Manag. **36**(3), 264–280 (2016)

4. VDI 4504 (Part II): Offer Documents for the Selling of Complex Technical Products (2010)
5. Elliot, A.J., Maier, M.A., Moller, A.C., Friedman, R., Meinhardt, J.: Color and psychological functioning: the effect of red on performance attainment. J. Exp. Psychol. General **136**(1), 154–168 (2007)
6. Holmqvist, K., et al.: Eye Tracking: A Comprehensive Guide to Methods and Measures. Oxford University Press, Oxford (2015)
7. Just, M.A., Carpenter, P.A.: A theory of reading: from eye fixations to comprehension. Psychol. Rev. **87**(4), 329–354 (1980)
8. Strobel, B., Lindner, M.A., Saß, S., Köller, O.: Task-irrelevant data impair processing of graph reading tasks: an eye tracking study. Learn. Instruct. **55**(6), 139–147 (2018)
9. Flesch, R.: A new readability yardstick. J. Appl. Psychol. **32**(3), 221–233 (1948)
10. Rayner, K.: Eye movements and attention in reading, scene perception, and visual search. Q. J. Exp. Psychol. **62**(8), 1457–1506 (2009)

Gravity Models for Latin American Economies

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Abstract. This research seeks to estimate a gravity model that allows to characterize trade between Latin American economies. An indexed triple gravity model is proposed, which considers fixed effects of time, exporting country and importing country. The gravity equations have been widely used for the prediction of international trade flows, but many of the models used for these purposes have problems of poor specification from an econometric point of view. Thus, the proposed model seeks to include simultaneously new variables or variables that have been consider independently, as well as, to provide a correct economic inference of the Latin American regional trade flows.

Keywords: Gravity models · Econometric modeling · Latin American · International trade

1 Introduction

The gravity equations have been widely used for the prediction of international trade flows, but many of these models have problems of poor specification from an econometric point of view. This investigation attempts to provide a correct economic inference of Latin American regional trade flows. Thus, this research aims to estimate a gravity model that allows to characterize trade between Latin American economies. To this end, we propose an indexed triple gravity model, which considers fixed effects of time, exporter and importer countries [1].

The objective is to determine the main variables that impact the volume of trade in the region of Latin America, identifying the reasons that explain the amounts of trade between each pair of countries. Simultaneously, the research considers the major economic integration issues for Latin America and the evolution of intra and inter industrial trade.

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The sample includes twenty Latin American countries, primarily from the continent, and the islands of Cuba, Haiti and Dominican Republic. Therefore, the sample considers 20 economic units, observed over a period of 25 years (1990–2014), elaborating a database by gathering the information related to the variables define to integrate the economic model and to be tested in the econometric one. Furthermore, the panel data model seeks to estimate the parameters of interest, the temporal and transversal variability of data. This application allows to characterize trade within the region and to determine the relevant variables for intraregional commerce, comparing with the different studies that have been conducted on the subject and the behavior of the new parameters include in this study.

The analysis focuses on bilateral trade in Latin America, pondering intraregional exports. The study contains and applies the econometric model to identify the significant variables, acknowledging their impact on regional commerce.

This research ultimately presents the findings of the application of the indexed triple gravity model and the recommendations for subsequent studies. The extended propose model is validated in relation to the classic gravity model, including additional explanatory variables such as the level of integration, women participation in labor force, the index of Intraindustrial Commerce, amongst others. The idea is to determine which ones are the ones that generates the gravitational force and, therefore, effect trade volumes in the region. Subsequently, the significance within the region of the variables traditional used in the literature is also validated. The findings highlight that the distance still a significant factor to explain the volumes of trade in Latin America and correctly represents the transport costs associated with international trade.

2 Methodology

The research analyzes the trade within the Latin American region using a gravitational model. A correlational model is formulated to clarify bilateral trade with explanatory variables according to the revision of the theoretical models. Then we proceed to formulate the model and describe each of the relevant variables that would explain Latin America regional trade between 1990 and 2014, the period under study.

This investigation considers as a core the role of the gravity model variables. The use of different indicators captures their potential influence on trade exchange by pairs of countries, as a first exploratory measurement. This is the reason why bilateral trade is the dependent variable, taking each pair of countries as two observations, exports from country I to j and then form country j to I since the variables of the gravity model effect both, the demand for imports as well as the export supply of the economies, becoming a measurement of bilateral trade as gravity models stipulate. The equation in its general form is as follows (ec. 1).

$$
\begin{aligned}
LnComBil_{ijt} = {} & \alpha_i + \gamma_j + \lambda_t + +\beta_1 LnR\_tcambio_{it} + \beta_2 LnR\_tcambio_{jt} \\
& + \beta_3 Lnreserv\_ext_{it} + \beta_4 Lnreserv\_ext_{jt} + \beta_5 nivel\_integ_{ijt} \\
& + \beta_6 Lnpib_{it} + \beta_7 Lnpib_{jt} + \beta_8 Lnpobl_{it} + \beta_9 Lnpobl_{jt} \\
& + \beta_{10} Lnarea_i + \beta_{11} Lnarea_j + \beta_{12} Lnpart\_muj_{it} \\
& + \beta_{13} Lnpart\_muj_{jt} + \beta_{14} Lnescolaridad_{it} \\
& + \beta_{15} Lnescolaridad_{jt} + \beta_{16} infla_{it} + \beta_{17} infla_{jt} \\
& + \beta_{18} com\_intra_{ijt} + \beta_{19} front\_comun_{ij} + \beta_{20} leng\_comun_{ij} \\
& + \beta_{21} Lndist_{ij} + \beta_{22} colonia_{ij} + \beta_{23} salida\_mar_i \\
& + \beta_{24} salida\_mar_j + \beta_{25} isla_i + \beta_{26} isla_j + \mu_{ijt}
\end{aligned}
\qquad \text{(ec. 1)}
$$

The data use in this study was elaborated from information obtain from different sources, such as the World Bank, CEppi, the International Monetary Fund, COMTRADE from the United Nations, among other.

3 Results

The database consists of a total of 20 countries acting as exporter and importers in a time horizon of 25 years, forming a balance data panel with 9500 observations.

When comparing the models obtain by applying the different methodologies for panel data, the results show that the consistent estimator to explain the volume of trade between countries is the application is a fixed-triple-index OLS model [1] for country of origin, country of destination and time, correcting with robust standardized errors clustered, finally obtaining a R^2 of 69,07%. The equation applied to the Latin America region is shown in Eq. 2 (ec. 2)

$$
\begin{aligned}
LnComBil_{ijt} = {} & \alpha_i + \gamma_j + \lambda_t - \underset{(0,029)}{0{,}584} LnR\_tcambio_{it}^{**} + \underset{(0,007)}{0{,}427} LnR\_tcambio_{jt}^{***} \\
& + \underset{(0,001)}{0{,}309} Lnreserv\_ext_{it}^{***} + \underset{(0,010)}{0{,}238} Lnreserv\_ext_{jt}^{**} + \underset{(0,000)}{0{,}409} nivel\_integ_{ijt}^{***} \\
& - \underset{(0,284)}{0{,}255} Lnpib_{it} + \underset{(0,000)}{0{,}807} Lnpib_{jt}^{***} + \underset{(0,009)}{3{,}144} Lnpobl_{it}^{***} - \underset{(0,302)}{1{,}305} Lnpobl_{jt} \\
& - \underset{(0,025)}{2{,}387} Lnpart_{muj_{it}}^{**} - \underset{(0,059)}{2{,}222} Lnpart_{muj_{jt}}^{*} + \underset{(0,000)}{2{,}540} Lnescolaridad_{it}^{***} \\
& + \underset{(0,104)}{1{,}080} Lnescolaridad_{jt} + \underset{(0,628)}{0{,}000038} infla_{it} - \underset{(0,276)}{0{,}00011} infla_{jt} \\
& + \underset{(0,000)}{1{,}620} Lncom\_intra_{ijt}^{***} - \underset{(0,784)}{0{,}065} front\_comun_{ij} + \underset{(0,060)}{1{,}186} leng\_comun_{ij}^{*} \\
& - \underset{(0,000)}{1{,}784} Lndist_{ij}^{***} - \underset{(0,817)}{6{,}807} + \mu_{ijt}
\end{aligned}
\qquad \text{(ec. 2)}
$$

** significativa al 10%; ** significativa al 5%; *** significativa al 1%*

The Real Exchange Rate for the exporting country was found to be significant at 5% and consistent with the findings stated by [2]. Thus, a 1% increase in the Real Exchange Rate of, which means an appreciation of the local currency, implies a decrease of 0.584%

in the exports of local producers, as exports are less competitive in the international arena due to the appreciation of the national currency. Likewise. The Real Exchange Rate of the importing country is significant at 1% with a coefficient of 0.427, which means that by increasing by 1% of the Real Exchange Rate of the importing country, its imports will increase by 0.427%, as the export currency depreciates in relation with domestic currency, becoming their goods and services relatively cheaper.

Regarding the amounts of Reserves that the countries hold to address their international commitments, the variable prove to be very significant, for both, exporting and importing countries. In the case of the exporting country, the variable represents the ability to defend exchange rate of this economy and maintain its competitiveness in the international markets. If the Reserves of the exporting country increases in 1% its exports increase by 0.309%. In turn, for the importing country the Reserves represents the capacity to finance its imports, consequently if the Reserves increase by 1%, its imports increase by 0.238%. The results are coherent with the literature [1].

The variable that represents the Level of Integration between pairs of countries is define as follows:

- Level 1 Partial Agreement between the pair of economies.
- Level 2 Free Trade Agreement (FTA) between the pair of economies.
- Level 3 Customs Union between the pair of economies.

This variable is highly significant and with a positive coefficient. In this regard, integration efforts in the region cause a greater volume of intraregional trade. This is in line with the proposal of [3], they declare that tariff preferences have been a stimulus for the application of trade agreements in intraregional commerce, despite the deficiencies that the regional integration processes present. Notwithstanding, the result is contrary to other authors proposals [4–7] who question the ability of integration to generate trade or who postulate that the tariff preferences negotiated in the region have been of little coverage or shallow to generate greater trade volume among the economies involved [8].

The GDP variable was not significative for the exporting country and, on the other hand, strongly significant for the importing countries. The coefficient of the importing country shows that in the region imports increase in 0.807% when GDP increases by 1%; thus, a higher income level increases imports demand, however this rise is inferior to the income surge.

The population variable proves to be significant only for the exporting country. A 1% increase in the population would cause an increase of 3.14% in exports volume. This may be explained by the fact that a larger population also implies a greater availability of the labor factor of production and, therefore, greater export supply.

Participation of Women in the labor force, usually considered as an indicator of economic openness, is significant at 5% for the exporting country and weakly significant for the importing country (significant at 10%). In the case of the exporting country, the coefficient shows that for a 1% increase in the Participation of Women in the labor force, export would decrease by 2.387%. Meanwhile, for the importing country an increase of 1% in the Participation of Women in the labor force would produce a decrease of 2,222% of imports. These findings imply that the postulate by [9] could be confirmed;

they point out a "resistance" of women to the effects of the opening of markets, causing a division between economic-political spaces. This resistance could be explained by the participation of the female workforce in import substituting or non-traditional sectors. As consumers, they may prefer domestic products.

The Schooling variable was strongly significant for the exporting economy and not significant for the importing economy. In the case of the exporting country, a 1% increase in schooling generates an increase of 2.540% in exports. These results coincide with those presented by [10], who understand Schooling as a way to measure the skills of human capital that produces export supply, a factor that enhances competitiveness and promotes the augment of exports because the economy is able to produce a higher export supply.

The Inflation was not significant in the application of the model, for either country. This is consistent with the macroeconomic premise that money or monetary parameters have no effect on the real sector. Thus, considering such period of analysis, this result could be expected.

The index of Intraindustrial Commerce (IIC) is significant with a coefficient of 1.62, so an increase of 1% of this Index would provoke a 1.62 increase on bilateral trade. This coincide with [11] findings, in the sense that product differentiation, economies of scale and product varieties would generate higher levels of trade. Furthermore, pertaining to [12], similar factor endowments, which induces economies convergence, would be a factor that would promote trade between pairs of countries.

Regarding the index of Intra-industrial Commerce (IIC), at regional level, defining as intra-industrial trade an index equal or greater than 0.3 because the index was calculate using customs classification at the level of chapter, it shows that only few relationships among pairs reach the category of intra-industrial commerce. The ones that surpass this level are the ones that belong to the same customs union or have a higher level of integration that the rest of the countries, such as Argentina, Brazil and Uruguay; likewise, the economies belonging to the Central American Central Market (Costa Rica, Guatemala, Honduras and El Salvador). Uttermost, the CII indicates intra-industrial trade for the larger economies in terms of income and greater participation in regional commerce, being the most important the pairs Brazil – Argentina and Mexico – Brazil.

The variables Seaside, Insularity and Area are omitted because they are invariant along time and only explain the situation of the economies i or j, but bilateral trade was defined as an ij variable, so the estimates that considers fix effects disregard this kind of parameters.

The Common Border is not significant. The geographical complexity of the Latin American area should be contemplated, because it could cause ambiguous relative transportation costs depending more on the difficulty of the access than the distance between two points. For example, transportation costs may be higher between bordering countries with an important geographical complexity than non-border countries with easy access for merchandise transportation, amongst all other combinations that may occur in the region.

Common Language is significant at 10% with a coefficient of 1.186, implying that pairs of economies that speaks the same language have greater trade than pairs of economies that do not have the same language. This result suggests an important role of cultural affinities on trade flows [13–15]. This factor could explain why Brazil is not

such a gravitating country in generating intra-regional trade despite its large economic size.

Distance is one of the fundamental variables for the model, since it represents the effect gravity produces by the proximity of the countries. In the intraregional model for Latin America, this variable is strongly significant nd consistent with the postulate by the gravity model. Pairs of countries that are 1% closer to each other have 1.784% more trade.

4 Conclusions

The present research responds to the objectives established, which sought to characterize intra-regional trade in Latin American, determining the relevance of the variables incorporated in the model according to the theoretical review of trade and gravity models applies in previous studies.

According to the model elaborated for trade within the region, trade would be affected by macroeconomic variables, in agreement with the findings presented in the literature [16–19].

Within the region, the Real Exchange Rate seems to be the factor that would effect both exporting and importing economies, reflecting their dependence on foreign currency, especially the ones use as international currencies over the domestic ones, the latter not being a referent for international markets. Another monetary variable that is relevant for trade is Reserves, which illustrates the economy capacity to maintain an stable Balance of Payments and impact also to importing and exporting economies. One characteristic of Latin American commerce is that Reserves influence more exports than imports; consequently, we infer that countries that export generate more confidence in the international markets and contribute more to transactions in the regional markets.

Related to macroeconomic variables, they behaved according to what it is expected from literature. Nevertheless, they have different behavior depending whether the economy is an exporting one or an importing one. Meanwhile GDP and inflation are not significant for the exporting country, his population increase export supply. On the other hand, importing economies' GDP increases the demand for foreign goods, whereas population and inflation are not relevant for the importing country. Therefore, the macroeconomic variables that promote trade are population of the exporting economies and GDP of importing countries. Considering the fundamental and basic variables of the gravity model, it would be expected that the economic size of the countries would be significant for importing and exporting country, not only for importer, likewise for population. Hence trade intraregional does not complies with all the results or findings obtained for other areas.

For future studies should be considered that gravity model may attain better or clearer results for economies that share some indicators and that in the long run may converge, thus, economies more homogenous. Consequently, the option of omitting certain countries with unique characteristic should be considered in comparison to the whole block, to estimate more reliable coefficients for the basic variables.

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References

1. Mátyás, L.: Proper econometric specification of the gravity model. World Econ. **20**, 363–368 (1997)
2. Mankiw, N.: Macroeconomía, 8° Edición. Harvard University, New York (2014)
3. Arimón, G., Correa, F., Fernández, D.: 30 años de integración en la ALADI. ALADI, Montevideo, Uruguay (2012)
4. Blaug, M.: La Metodología de la Economía. Alianza Universidad, Madrid (1980)
5. Pelkmans, J.: Un nuevo enfoque de las teorías de la integración económica en: Salgado, G. (comp) Economía de la Integración Latinoamericana, Lecturas seleccionadas. Buenos Aires, BID-INTAL. Tomo I (1989)
6. Bhagwati, J.: Regionalism versus multilateralism. In: World Bank and CEPR Conference on New Dimensions in Regional Integration. Washington: Session I, Paper 1 (1992)
7. Salgado, G.: Modelo y políticas de integración (1993). http://www.revistaei.uchile.cl/index.php/REI/article/viewFile/15699/21141. Accedido 22 de junio 2015
8. Bárcena, A., Prado, A., Rosales, O., Pérez, R.: Integración regional hacia una estrategia de cadenas de valor inclusivas. Naciones Unidas, Santiago de Chile (2014)
9. Marchand, M., Sisson, A.: Gender and Global Restructuring. Sighting, Sites and Resistences. The Ripe Series in Global Political Economy. Routledge, London and New York (2000)
10. Frankel, J., Rose, A.: An estimate of the effect of common currencies on trade and income. Q. J. Econ. **117**(1), 437–466 (2000)
11. Grubel, H.G., Lloyd, P.J.: Intra-industry Trade: The Theory and Measurement of International Trade in Differentiated Products. Wiley, New York (1975)
12. Krugman, P.: Intra-industry specialization and the gains from trade. J. Polit. Econ. **89**, 959–973 (1981)
13. Frankel, J., Rose, A.: An estimate of the effect of common currencies on trade and income. Q. J. Econ. **117**(2), 437–466 (2002)
14. Lewer, J., Saenz, M.: Efectos de la liberación financiera sobre el comercio exterior: modelo gravitacional de Latinoamérica 1995–1999. Estudios Económicos de Desarrollo Internacional **4**(2) (2004)
15. Anderson, J., Van Wincoop, E.: Gravity with gravitas: a solution to the border puzzle. Am. Econ. Rev. **93**, 170–192 (2003)
16. Coughenour, C., Paz, A., De la Fuente-Mella, H., Singh, A.: Multinomial logistic regression to estimate and predict perceptions of bicycle and transportation infrastructure in a sprawling metropolitan area. J. Public Health **38**(4), 401–408 (2016)
17. Paz, A., De la Fuente-Mella, H., Singh, A., Conover, R., Monteiro, H.: Highway expenditures and associated customer satisfaction: a case study. Math. Probl. Eng. **2016**(4630492), 1–9 (2016)
18. De la Fuente, H., Vallina, A.M., Solis, R.: Stochastic analysis of the economic growth of OECD countries. Economic Research-Ekonomska Istraživanja (2019). https://doi.org/10.1080/1331677x.2019.1685397
19. Coughenour, C., De la Fuente-Mella, H., Paz, A.: Analysis of self-reported walking for transit in a sprawling urban metropolitan area in the western U.S. Sustainability. **11**(852), 16 (2019). https://doi.org/10.3390/su11030852

A Critical Review of Absorptive Capacity Measurement and Misspecification in Business Research

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Abstract. The aim of this research is to critically review absorptive capacity conceptualization and operationalization. Although Cohen and Levinthal [1] emphasized multidimensionality of absorptive capacity, researchers have conceptualized it as a unidimensional construct, encompassing knowledge acquisition, assimilation, transformation and exploitation. From epistemological and ontological perspectives, knowledge acquisition and assimilation differ from other capacities, namely, knowledge transformation and exploitation. Knowledge acquisition and assimilation represent knowledge conversion from explicit-to- tacit and tacit-to-tacit processes that should be done at the individual level of analyses. Accumulated and assimilated knowledge with organization learning facilitate the transformative process to exploit knowledge for business purposes. Thus, absorptive capacity (ACAP) should be conceptualized and operationalized as a multilevel, multidimensional and latent construct involving distinctly dynamic capabilities. It involves a new way of thinking from epistemological and ontological perspectives. In addition, there is a paucity of research regarding ACAP measurement and specification. The current research provides a theoretical framework on how the measurement of ACAP should be taken in terms of its relation to indicators and order level.

Keywords: Absorptive capacity · Potential absorptive · Realized absorptive capacity · Epistemology · Ontology

1 Introduction

There is ample evidence that knowledge absorptive capacity has great impact on the firm's learning, innovation, performance and competitive advantage [1, 2, 12, 20]. Following the research line of Cohen and Levinthal [1] absorptive capacity refers to the firm's recognition of the value of new external knowledge, assimilating it, and applying it to commercial ends [1]. However, in recent years, absorptive capacity has undergone several reconceptualization [2, 3]. Zahra and George [2] argue that ACAP should comprise two significant subcontracts: potential ACAP and realized ACAP. They substitute the component "recognizing the value" with acquisition and transformation. In this

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respect, ACAP refers to dynamic capability formed by a set of organizational routines of knowledge acquisition and assimilation as well as knowledge transformation and application. Activation triggers moderate knowledge acquisition and assimilation (potential ACAP), while social integration mechanism moderates the relationship between potential absorptive capacity (PACAP) and realized absorptive capacity (RACAP) encompassing transformation and exploitation. Todorova and Durisin [3] suggest a reintroduction of recognizing the value of external knowledge an alternative understanding of transformation. Furthermore, the ACAP construct is based on organization level of analysis and thus, the application of this construct as an individual level of analysis may lead to misconceptualization and operationalization [20]. The process of ACAP scale measurement operationalization and validation continues to be challenging in the knowledge management literature. Undoubtedly, part of the problem is that researchers fail to adequately define construct knowledge domains, components and dimensions. The first issue is whether ACAP construct has a multiple sub- dimensions. The second is the nature of the relationship between the sub-dimensions and the higher order construct. Therefore, the aim of this research is to shed light on the ACAP conceptualization as a latent, multidimensional construct that involves a new way of thinking from epistemological and ontological perspectives. Our aim in reviewing the existing conceptualization of ACAP construct is to reduce such confusion embedded in the theorizing process of the construct component, processes and measurements.

2 Literature Review

2.1 Absorptive Capacity Conceptualization

Although the concept of ACAP initially appeared in the context of technology transfer, Cohen and Levinthal's [1] article is generally accepted as the foundation of ACAP construct. Cohen and Levinthal [1] view absorptive capacity as firm's ability to recognize the value of new external knowledge, assimilate it, and apply it to commercial ends. The premise of the ACAP concept is that a firm needs prior related knowledge to assimilate and use new knowledge [1]. Thus, a firm ACAP depends on the ACAP of its knowledged workers. It is a firm cognitive abilities and efforts of its individual members. Zahra & George [2] broaden ACAP from the original three dimensions (recognize the value of new knowledge, assimilation and exploitation) to four dimensions, acquire, assimilation, transformation and exploitation. According to Zahra and George [2], absorptive capacity exists as two sub-constructs: Potential ACAP and realized ACAP. PACAP comprises knowledge acquisition and assimilation capabilities and RACAP construct contains knowledge transformation and exploitation. Knowledge acquisition refers to a firm's capability to identity and to acquire externally generated knowledge. Assimilation capability refers to the firm's routine and process that allow it to analyze process, interpret and understand knowledge [1, 5]. External knowledge enables the firm's internal knowledge to be extended by stimulating and assimilating knowledge potential capacities and innovation capabilities [4, 9, 10]. Transformation is a firm's capability to develop and refine the routines that facilitate combining existing knowledge and the newly acquired and assimilated knowledge. Exploitation capability is the ability to refine, extend and

leverage existing knowledge or to create new ones by incorporating acquired and transformed knowledge into its operations. It reflects a firm's ability to harvest and incorporate knowledge into operations [11]. However, transformation and exploitation are not steps after knowledge acquisition and assimilation but represent distinct knowledge capacity subset [12, 13]. Zahra and George [2] theorized that the relationship between PACAP and RACP is moderated by social integration. Potential ACAP represents knowledge seeking capabilities, whereas RACAP is the starting point of knowledge transfer process [13]. Todorova and Durisin [3] further argue that there are serious ambiguities and omissions in Zahra and George [2] reconceptualization of ACAP and call into question the splitting of the construct into the subsets of ACAP and RACAP. Further, Todorova and Durisin [3] suggest a reintroduction of "recognizing the value of external knowledge and clarification of potential ACAP". Contrary to Todorova and Durisin [3] position, the research findings of Flatten et al. [6] show that transformation is an integral part of ACAP. Consequently, they argue that recognizing transformation process helps to open the black box that has dominated the prior research. Volberda et al. [10] proposed an integrative framework for ACAP. They suggest that there is a vital need to consider intra organizational antecedents as significant drivers of ACAP. However, all models reviewed consider assimilation and exploitation as components of ACAP, and most other models also consider recognizing the value of external knowledge (acquisition) and transformation as important components of the construct [12, 13, 21]. Furthermore, even though Cohen & Levinthal's work [1] highlights to multidimensionality of ACAP, researchers have measured it as a unidimensional construct. They measure ACAP with simple research and development (R&D) proxies ignoring the construct dimensions and implications. These shortcomings suggest a need for a more valid measure that captures the multiple dimensions of ACAP [14]. Other shortcomings of ACAP literatures are limited attempts to conceptualize the construct and little attention is given to the actual process or dimensions underlying ACAP [18]. The reasons behind this insufficient conceptualization of ACAP as a complex and multilevel construct may be attributed to limited research attention to its dimensionality, antecedents and knowledge stickiness [15, 17]. Accordingly, fundamental epistemological, ontological and axiological differences between knowledge ACAP dimensions or processes are neglected.

3 Critical Review of ACAP Conceptualization

The majority of the research in the ACAP literature has viewed knowledge as static knowledge resources and not as a process or dynamic capability [7, 12]. ACAP researchers tend to perceive knowledge as explicit knowledge that can be transformed and exploited. Therefore, in addition to recognizing transformation and exploitation, explicit knowledge process researchers also conceptualized acquisition and assimilation as an explicit knowledge process at organizational level of analysis. The emergence of ACAP from the actions and interactions of individuals and organization levels remains unclear [11]. In contrast, Cohen and Levinthal [1] highlight the importance of individual's cognitions and organizational learning to recognize and assimilate new external knowledge. Thus, from epistemological and ontological perspectives, knowledge acquisition capacity and assimilation capacity differ from other capacities, namely, knowledge transformation and exploitation. Table 1 illustrates the difference between ACAP dimensions

or processes from epistemological, ontological and cognition perspectives. Furthermore, a firm's ACAP starts from individual's recognition of the value of new external knowledge. It depends on the individual ACAP and its relations to prior existing knowledge within a firm. A firm cannot actually assess the value of external knowledge if their knowledge workers fail to recognize, perceive and assimilate this knowledge.

Table 1. Difference between ACAP processes

	Acquisition	Assimilation	Transformation	Exploitation
Epistemology	Internalization	Internalization	Externalization practices	Externalization
Ontology	Individual	Individual	Organizational	Organizational
Knowledge conversion	Explicit tacit	Tacit-Tacit	Tacit-Explicit	Tacit- Explicit Explicit- Explicit
Cognition	Knowledge static	Knowledge dynamic	Dynamic process	Knowing dynamic process
Knowledge capacity	Potential	Potential	Realized	Realized

Thus, knowledge acquisition and assimilation represent knowledge conversion from explicit-to-tacit and tacit-to-tacit processes that should be done at individual level of analysis. Accumulated assimilated knowledge (external and internal knowledge) with organizational learning facilitate process to capsulate and exploit knowledge for business purposes. Thus, ACAP should be conceptualized and operationalized as a multilevel construct (individual and organizational) and multidimensional and learning models, involving distinctly dynamic capabilities. Knowledge ACAP does not reside in an individual's mind, nor is it an aggregate of organizational knowledge [8]. Rather it depends on the dynamic process and interaction between individual and organizational level of analysis. We believe that the failure to understand ACAP as multidimensional, latent and multilevel construct and its components will exert detrimental effect on the construct measurement and its operationalization. ACAP includes a set of four different dynamic capabilities that should be associated and build upon one another to create a firm knowledge capacity. Although, ACAP is recognized as a multilevel construct, scholars tend to omit the role of knowledge workers or they attempted to adapt measures of a firm to the individual level [11, 12, 16]. Thus, ACAP construct should be conceptualized as two different subset, acquisition and assimilation dynamic capacities which represent an individual cognition process and the organizational level of knowledge conversion incorporated with transformation and exploitation capacities. The individual cognition process implies explicit-to-tacit conversion whereas practical encapsulated process implies tacit-to-explicit and explicit-to- explicit knowledge conversion at a firm level. Therefore, the process of ACAP conceptualization and operationalization continues to be challenging in the literature. Undoubtedly, part of the problem is that researchers fail to adequately theories construct knowledge domain, its components, and dimensions. The first issue

whether ACAP construct has multiple dimensions that involves individual and organizational level of analysis. The second important issue is the nature of the relationship between construct dimensions, processes of knowledge conversion and the higher order construct.

4 Absorptive Capacity Measurement and Misspecification

Some researchers addressed ACAP as a composite construct which posited that the construct is a total sum of its measures.

Further, researchers have not confirmed the direction of causality that should be posited either from construct to measures (reflective measurement model) or from measures to construct (formative measurement model). Thus, researchers need to conceptualize carefully this construct and identify the direction of causality between potential absorptive capacity, realized absorptive capacity and their measures [19, 22]. Using absorptive capacity as composite latent construct without distinguishing between absorptive capacity processes will result in inconsistent estimates and misspecification. More specifically, absorptive capacity should be modeled as two different sub constructs: potential and realized and as having formative measures or reflective measures when researchers follow specific conditions that are associated with reflective and formative measurements models. In such cases, further theoretical, methodological and conceptualization of the construct may be needed. This may require researchers to clarify absorptive capacity at more order level which sometimes include multidimensional second order level. If we view absorptive capacity as being multidimensional and consisting of acquisition, assimilation, transformation and exploitation components, the question that should be considered is the abstract order level of the relationship between these four capacities and the higher order level.

5 Conclusion and Implications

Despite the huge growth in the ACAP literature, certain essential gaps still remain, specifically, the construct conceptualization and operationalization. This research attempts to draw attention to the epistemological and ontological distinction between knowledge absorptive capacity components. Also, it provides a set of conceptual differences for deciding on the appropriate construct operationalization. Our critical review of ACAP conceptualization suggests that there are important theoretical and empirical distinctions between knowledge acquisition and assimilation which represent an individual level of analysis and knowledge transformation and exploitation at a firm level. In closing, this research assumes that failure to recognize the distinction among ACAP capacities from epistemological and ontological perspectives will have a number of detrimental effects on the construct power and validity. Therefore, it's imperative for the knowledge management field to think more carefully about ACAP reconceptualization and operationalization and do better understanding of the dynamic and multidimensionality of the construct. Nevertheless, the current research has useful implications. First, there is little guidance rice in the knowledge management literature on how to conceptualize ACAP construct. Second, this research provides a theoretical framework on how the

measurement development process of ACAP should be taken in terms of its relation to indicators and order level of analysis.

Furthermore, this research attempts to draw attention to the epistemological and ontological distinction between knowledge absorptive capacity components. It provides a set of conceptual differences for deciding on the appropriate construct operation. Our critical reviews of ACAP conceptualization suggest that there are important theoretical and empirical distinctions between knowledge acquisition and assimilation which represent an individual level of analysis and knowledge transformation and exploitation at firm level [21–23].

In closing, we believe that failure to recognize the distinction among ACAP capacities from epistemological and ontological perspectives will have a number of detrimental effects on the construct, power and validity. Therefore, it's imperative in the knowledge management field to think more carefully about ACAP reconceptualization and operationalized and do better understanding of the dynamic and multidimensionality of the construct.

Additionally, the current research has useful implications. First, there is little guidance in the knowledge management's literature on how to conceptualize ACAP construct. Second, this research provides a theoretical framework on how the measurement development process of ACAP should be taken in terms of its relation to indicators and order level of analysis. However, this research is regarded as a first step, and an important next step would be to examine the correctness of our understanding and critical review.

References

1. Cohen, W.M., Levinthal, D.A.: Absorptive capacity: a new perspective on learning and innovation. **35**(1), 128–152 (1990)
2. Zahra, S.A., George, G.: Absorptive capacity: a review, reconceptualization, and extension. Acad. Manag. Rev. **27**(2), 185–203 (2002)
3. Gergana, T., Durisin, B.: Absorptive capacity: valuing a reconceptualization. Acad. Manag. Rev. **31**(3), 774–786 (2007)
4. John, B., Trifilova, A.: Developing absorptive capacity for recombinant innovation. Bus. Process Manag. J. **23**(6), 1094–1107 (2017)
5. Patterson, W., Ambrosini, V.: Configuration absorptive capacity as a key process for research intensive firms. Technovation **36–37**, 77–89 (2017)
6. Flatten, T., Adams, D., Brettle, M.: Fostering absorptive capacity through leadership: a cross-cultural analysis. J. Bus. World **50**, 519–534 (2015)
7. Lau Antonio, K.W., Lo, W.: Regional innovation system, absorptive capacity, and innovation performance: an empirical study. Technol. Forecasting Soc. Change **92**, 99–114 (2015)
8. Cesar, C., Fores, B.: Knowledge capacity: new insights for its conceptualization measurement. J. Bus. Res. **36**, 707–715 (2010)
9. Thomas, R., Emma, W.: Innovation in tourism-conceptualizing and measuring the absorptive capacity of the hotel sector. Tourism Manag. **45**, 39–48 (2014)
10. Volberda, H., Foss, N., Lyles, M.: Absorbing the concept of absorptive capacity: how to realize its potential in the organization field. Organ. Sci. **21**(4), 931–951 (2010)
11. Lane, P., Koka, B., Pathak, S.: The reification of absorptive capacity: a critical review and rejuvenation of management review. **31**(4), 833–863 (2006)
12. Leal-Rodriguez, A.L., Ariza-Montes, J.A., Jose, L.L., Leal-Millan, A.G.: Absorptive capacity, innovation and cultural barriers: a conditional mediation. J. Bus. Res. **67**, 763–768 (2014)

13. Flatten, T.C., Andreas, E., Zahra, S.A., Brettel, M.: A measure of absorptive capacity: scale development and validation. Eur. Manag. J. **29**, 98–116 (2011)
14. Everist, L., Bernroider, E.W.N.: The roles of absorptive capacity and cultural balance for exploratory exploitative innovation in SEMEs. J. Bus. Res. (2017). http://dx.doi.org/10.1016/j.busres.2017.10.052
15. Nicholas, R.: Absorptive capacity, organizational antecedents and environmental dynamic. J. Bus. Res. (2015). http://dx.doi.org/10.1016/o/j.busres.2015.02.0/9
16. Marktinkenaite, L., Preunig, K.J.: The emergence of absorptive capacity through micro-micro level interactions. J. Bus. Res. **69**, 700–708 (2016)
17. Lane, P., Jikoka, B., Pathak, S.: Thematic analysis and critical assessment of absorptive capacity research. Academy of Management Proceeding Bps: MI (2002)
18. Roberts, N., Galluch, P.S., Dinger, M., Grover, V.: Absorptive capacity and information systems research, review, synthesis, and direction for future research. MIS Q. **36**(2), 625–648 (2012)
19. Shijia, G., Yeoh, W., Wong, S.F., Scheepers, R.: A literature analysis of the use of absorptive capacity construct in research. Int. J. Inf. Manag. **37**, 36–42 (2017)
20. Petti, C., Zhang, S.: The role of absorptive capacity in Chinese firms. Measur. Bus. Excellence **20**(2), 1–12 (2016)
21. Jarvis, C.B., Scott, B., Podsakoff, P.M.: A critical review of construct indicators and measurement model misspecification in marketing and consumer research. J. Consumer Res. **30**, 199–217 (2005)
22. Forenell, C., Larcker, D.F.: Evaluating structural equation models with unobservable variable and measurement error. J. Market. Res. **18**(February), 39–50 (1980)
23. Churchill Jr., G.A.: A paradigm for developing better measures of marketing constructs. J. Market. Res. **16**(February), 64–73 (1979)

The Philanthropy of Chilean Citizenship: A Quantitative Data Science Study

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Abstract. The trust and perceptions that can be generated between civil society and organizations receiving philanthropy are key to a link that becomes more complex, since there is evidence of distrust in local and global social contexts that raise new forms of intermediation necessary to the measurement. The research aims to focus on the types of donations that Chileans, as natural persons, are delivering or are willing to deliver in recent months, also marked by a context of greater economic uncertainty. The measurement made in this research has a national character, with consultations in all regions of the country, incorporating data science techniques in the collection and automated processing of information for mass data. The results of the research show that a majority of the population at the national level would be willing to donate money to a charitable cause (91.58%), while 66.41% declare to have donated money to a charitable cause in the last 12 months.

Keywords: Philanthropy · Chilean citizenship · Business intelligence

1 Introduction

The way to reach citizenship has changed, it is no longer about who appears more on TV, or sends more emails, or who invests more in advertising campaigns, now it is about investing money intelligently. In a world where people have the possibility to skip, ignore or block advertising, it becomes essential to capture the attention of the right people, through the right message, at the right time [1].

Forecasting analysis, or predictive models for decision making, group a variety of statistical techniques (statistical models), machine learning and data mining that analyze actual and historical actual data to make predictions about the future or unfamiliar events [2].

Forecasting analysis is one of the tools that are part of a broader set of techniques known as "Business Intelligence." To cite one example, the demand for specialists in predictive analysis has grown in the U.S. at an annual rate of 27%, when the average

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in that country for the rest of the demands is 11%. A figure that perfectly illustrates the enormous importance that administrations, companies and organizations are giving to predictive analysis. This tendency to use predictive analysis is a consequence of the new culture that has become widespread with respect to data. The real capacity to store and process large data sets, linked to the advances experienced by IT, has allowed the generation of massive data files of all types, which can be analyzed for trends.

In the field of economics/business/business intelligence/accounting data analysis, digital communication, predictive models extract patterns from historical and transactional data to identify determinants, risks, behaviors and opportunities. This is how predictive models identify relationships between different factors that allow the assessment of risks or associated probabilities on the basis of a set of conditions, allowing the decision maker to objectify their tasks with a greater degree of efficiency/effectiveness [3].

The expected result of this type of methodologies is that the predictive analysis provides a score or probability of occurrence for each "id" or "cross section" actually subject in a sample (client, employee, patient, product, vehicle, component, machine, business unit, etc.), in order to determine, inform or influence processes in the organization in which a large number of subjects participate, such as in marketing, in credit risk assessment, in fraud detection, product manufacturing, health, government operations, social issues, etc. [4, 5].

Thus, Data Science, we could define it as: "Set of methods and tools that support decision making, using mathematics and statistics." [1].

Through a strategic alliance, we have approached the efforts and capabilities of a academic group of "Pontificia Universidad Católica de Valparaíso" who contribute with the development, generation and theoretical validation of knowledge, and a private world company (Statknows), who contributes with the algorithms of artificial intelligence that browse the Big Data, collecting and analyzing information from more than 1,000,000 people in each search, to find those who meet the required profile of the research, which allows to know exactly who to target and what message. The above is achieved through obtaining representative samples in media such as: Facebook, Twitter or Google AdWords, of people who meet customer interest characteristics and who are willing to answer their questions.

Now, and in relation to the research developed, on many occasions we have heard of Chile as a solidarity country, however, it has also been noted, through some surveys, that groups such as young people in our country believe less in this condition of solidarity, or there is a perception of distrust towards a number of organizations that could be affecting donations.

Philanthropy in this research will not be understood as that referred to the contributions of large companies, but to the reality of people who are part of a community or a specific cultural context, that is, what is called citizen philanthropy, understood as the practice of voluntary private donations of varied resources (money, time, work, networks) made by citizens for the common welfare [6, 7].

Citizen philanthropy is not that referred to the contributions of large companies, but to the reality of people who are part of a community or a specific cultural context. It coexists with spontaneous and reactive exercises (help once based on the request), with

greater discernment (donate regularly for a more permanent commitment), and with a high degree of involvement in more specialized tasks (such as volunteering). This type of philanthropy strengthens social empathy because it can deliver necessary solutions to collective and also more specific problems, for example, from an initiative such as the "Teleton" to the disease situation in a given family, contributing to the formation of social capital and strengthening the social cohesion [8, 9].

Therefore, the following research aims to focus on the types of donations that Chileans, as natural persons, are delivering or are willing to deliver in recent months, also marked by a context of greater economic uncertainty [10].

In the framework, moreover, of a recent and unpredictable social explosion in Chile, where part of the debate has focused on the existing levels of inequality, institutional crisis and public trust. By the way, citizen philanthropy actions are necessary to measure and quantify the motivations of those who still believe in people and their organizations.

In this type of behaviour that favours the community, aspects can be found that allow to explain the bonds of bond and collaboration exercised between the citizenry, stimulating the correct functioning of democracy [11]. This becomes very important in times of political and economic instability.

2 Methodology

The measurement made in the present research has a national character, with questions in all regions of the country, incorporating data science techniques in the collection and automated processing of information for massive data. Thus, the research applies artificial intelligence to monitor responses at the level of social networks, as a way to purify technologically new ways to survey and measure in a digital environment and naturalized by the subjects.

To begin with the study of philanthropy and particular in relation to obtaining the sample, people with the desired characteristic were limited: potential public who is interested in the issues of social control of public funds; to invite them to complete the questionnaire.

The sample was actively adjusted so that the responses obtained were representative of the target market in the population. When we refer to "representative samples" we do so from the horizon of statistical science, that is, ensuring that the collected data sample meets mathematical standards to deliver an accurate inference that faithfully represents the study population.

The sample size corresponded to 1,057 valid individuals, the geographical area corresponds to the entire continental territory of Chile at the region level, with a sample error of 3.2%. The distribution of the sample is possible to see in the Table 1.

3 Results

The results of the research indicate that a majority of the population at the national level would be willing to donate money to a charitable cause (91.58%), while 66.41% declare have donated money to a charitable cause in the last 12 months. However, the region that responds that has donated less money in the last year is that of Aysén, with

Table 1. Distribution of the sample

Country region	%	n	Error
Total national	100%	1,057	3.24%
RM Santiago	41%	470	5.53%
Bío-Bío	12%	135	7.50%
Valparaíso	11%	117	7.63%
Araucanía	6%	41	8.17%
Maule	6%	50	8.10%
O´Higgins	5%	39	8.19%
Los Lagos	5%	38	8.19%
Antofagasta	4%	33	8.23%
Coquimbo	3%	42	8.16%
Los Ríos	2%	25	8.29%
Atacama	2%	12	8.39%
Arica	1%	13	8.38%
Tarapacá	1%	20	8.33%
Aysén	1%	9	8.41%
Magallanes	1%	13	8.38%

44.44%; while Atacama is the region that states that more contributions have been made to a charitable cause in the same period (83.33%). The Metropolitan Region is slightly above the national average with 67.23% of donations, while the Valparaíso Region is below the national average with 53.84%.

When asked about the type of causes in which Chileans would be most interested in supporting money at the national level, 48% said they were more sensitized by older adults, 45% by social causes, 38% by those affected by natural disasters, 29% for education, 18% for culture, same percentage for research and innovation, 11% for art and 6% for public policy projects.

About the question in which media would like to be informed about which donations to make, a significant 58% can be seen nationally, manifesting the option of social networks, 38% of television, following the web with 34%, mobile applications (27%), testimonials (20%), press (18%), radio (16%), visits (11%) and magazines 8%.

Regarding the ways of donation, 51% express preferring anonymous private donation, 38% public private donation, 3% donation via business and 9% unanswered.

The reasons why you donate are: because you feel a commitment and obligation to society (24.88%); by charity (23.02%); because the government does not help people with need (21.51%); to contribute to the development of the country (8.22%); for religious beliefs (6.81%); because they have money to help others (4.08%); because I am interested in developing a philanthropic project (3.21%); donations are tax deductible (1.02%); null (7.22%).

On the question, how the donation is usually given: 58% say they deliver it directly to the person in need, 23% give it through institutions or organizations, 5% through their own philanthropic project.

The reasons for donating are focused on the passionate philanthropic project (37%); the inspiration aroused by other philanthropists (23%); the highest income you have (7%) and tax incentives, with 4%. The remaining 29% is null.

Around the elements to trust, "knowing the organization for years", is the main cause of trust to donate with 37%; then "the testimony of the beneficiaries" follows (20%); "Know the objectives of the charity" (18%); "Known and respected people work in the charity" (12%); and the "existence of a web page" (7%).

When identifying the type of organization to which it was donated in recent months, it is pointed out that those related to health (22%); religious (16%); those linked to people with limited resources (16%); help for older adults (15%); environmental groups (9%); humanitarian organizations (8%); youth groups (4%); sports clubs (4%), artistic or cultural associations (2%); universities (2%); the rest of educational (1%).

On ways to contribute to social causes, 31% say that making donations for "Teleton"; 14% giving alms to people on the street; 13% participating in collections; 10% donating food, food or clothing; 9% with volunteer work; 6% through periodic payroll or salary deductions; 5% buying items from philanthropic institutions such as UNICEF; 4% to those advertised online; 2% responding to a request made by radio or television; 6% null.

Older adults would attract the greatest interest of citizens when making donations with money nationwide (48%), followed by social causes (45%), among others. It is striking that those consulted would be willing to make contributions in education (29%) and it emerges as another emerging intention, to donate money in scientific, academic research and innovations (18%).

The media are recognized by the public as platforms for information and guidance regarding donations they can make. In the online field, 58% say they would like to inform themselves through social networks to decide, 34% on the web and 27% on mobile applications. In traditional media, 38% on television, 18% press, 16% radio and 8% magazines. They complete testimonies and visits, with 20% and 11%, respectively.

It is donated because it feels a commitment and obligation to society (24.88) along with the fact of charity (23.02%), but also because it is perceived that the government does not help people in need (21.51%), among the biggest trends.

Although 6.81% of the citizens express that they donate for "religious beliefs", the contribution to churches is 16%, the highest after the donations made in the last twelve months to institutions linked to the health (22%) and sharing the same percentage with those who help people with limited resources (16%). It also stands out in contributions to the institutions, the help for the elderly (15%).

Thus, the research shows a real interest of the citizens to make donations in money to a charitable cause (91.58%) that materializes in effective donations made in the last year (66.41%). The gap between the intention or provision and the donation as such can be explained by the current economic disparity in certain regions. Donations are being delivered by citizens directly to people in need (58%) compared to 23% in which institutions or organizations mediate at the time of contribution.

Finally, the research shows that a motivation to donate is when the philanthropic project "passionate" (37%), but also the inspiration that other philanthropists arouse in citizens (23%), among the most important to highlight. The confidence to donate lies in the knowledge for years of the organization (37%%) as the main cause detected, also the testimony of the beneficiaries (20%), as the most prominent trends. Donations in the "Teleton" account for 31% of the citizens' responses when expressing their contribution to social causes. They continue to give alms to people on the street (14%) and participation in collections (13%), among others.

4 Conclusions

Through the use of analytical techniques for the treatment of massive data, it was possible to determine the profile of the types of donations that Chileans are giving or are willing to deliver in the short/medium term. The foregoing will be useful to subsequently carry out a characterization of donors in Chile and conduct prospective studies in this area.

This research has allowed us to develop this philanthropy study, and will allow us to generate future research that will collect the national and international contingency, through the analysis of multidimensional data with an "immediate" response capability, which will lead us to develop and create new predictive models regarding the behavior of society on the various topics of study, all analyzed in real time, and under the validation and generation of new knowledge, which is the ultimate goal of Higher Education Institutions and of our University, with a strong applied component and a firm commitment to society.

Research using models of this nature to deepen the aspects of citizen philanthropy, allows us to advance our reflection on social cohesion, a dimension of relevance to the current democratic challenges. Philanthropy promotes a healthy, sustainable and democratic civil society by building the foundations for pluralism, civic participation, equity and social justice [12].

Even, at a time of social questioning of the growth patterns of the Chilean economy and the distribution of its income, philanthropy can help to reduce the deep and unjust gap between the rich and the poor [13] or at least to contribute to the debate on what may be the most important challenge of the new philanthropy of the 21st century [13].

In fact, it may be relevant to future research in Chile with the techniques exposed of data science, forms of philanthropy more oriented to social justice, because its drivers point to change the structural conditions that generate the great evils of society, such as the persistence of poverty, inequality, authoritarianism, violation of human rights or various forms of social exclusion [14].

The study infers the coexistence of types of social philanthropy, in which the importance of the digital and the provision of transparent information on web media gain prominence. However, the role of civil society organizations in motivating, organizing and channeling citizen philanthropy is still important.

Finally, important civic convictions of philanthropy are appreciated in research because it perceives a state or a governmental structure that cannot provide relevant and quality responses to citizens in sensitive areas such as health, older adults and education. This leads us to project in the near future the timely and innovative response

capacity of the institutions and the effectiveness of the respective solutions. That is, measure the complex social challenge that requires a strategic orientation for Chilean citizen philanthropy and its potential dialogue with public policies.

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References

1. Gandomi, A., Haider, M.: Beyond the hype: big data concepts, methods, and analytics. Int. J. Inf. Manag. **35**(2), 137–144 (2015)
2. Kenneth, O.: Cogger: specification analysis. J. Am. Stat. Assoc. **68**(344), 899–905 (1973)
3. Paz, A., de la Fuente-Mella, H., Singh, A., Conover, R., Monteiro, H.: Highway expenditures and associated customer satisfaction: a case study. Math. Probl. Eng. **2016**(4630492), 1–9 (2016)
4. Coughenour, C., Paz, A., de la Fuente-Mella, H., Singh, A.: Multinomial logistic regression to estimate and predict perceptions of bicycle and transportation infrastructure in a sprawling metropolitan area. J. Public Health **38**(4), 401–408 (2016)
5. de la Fuente-Mella, H., Navarro, M.M., Reyes, M.J.: Análisis de la satisfacción universitaria en la Facultad de Ingeniería de la Universidad de Talca. Ingeniare. Revista Chilena de Ingeniería **18**(3), 350–363 (2010)
6. Andreoni, J.: Handbook of the economics of giving, altruism and reciprocity. **2**, 1201–1269 (2006)
7. Maki, A., Dwyer, P.C., Blazek, S., Snyder, M., González, R., Lay, S.: Responding to natural disasters: examining identity and prosociality in the context of a major earthquake **58**(1), 66–87 (2019)
8. Tracey, P., Phillips, N., Haugh, H.: Beyond philanthropy: community enterprise as a basis for corporate citizenship. J. Bus. Ethics **58**, 327–344 (2005)
9. de la Fuente-Mella, H.: The importance of trust and commitment in the relationship and behavior of benefactors and non-profit organizations: a normative theoretical study panorama socioeconómico. **25**(34), 60–69 (2007)
10. Calandra, B.: Cultural philanthropy and political exile: the Ford Foundation between Argentina and The United States (1959–1979). **25**(2), 453–469 (2019)
11. Putnam, R.: Making Democracy Work: Civic Tradition in Modern Italy. Princeton University Press, Princeton (1993)
12. Harris, C.: Making Grants: The Social Justice Gap. Ford Foundation Report, Summer, 46–47
13. Chen, L.: Philanthropy for Global Equity: The Next Wave? Harvard Review of Latin America, Spring. Boston: Harvard University, pp. 74–75 (2002)
14. Millner, A.: Change or charity? Alliance **8**(3), 21–24 (2003)

Probabilistic Models of Job Placement and Positioning for Students with a Career in Chile

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Abstract. The purpose of this research is to determine the factors that affect the insertion and job positioning of women professional graduates of the public accountant and auditor of the Universidad del Bío-Bío, Chile. The data were obtained through a questionnaire applied to the graduates. Given the dichotomous nature of the dependent variable, logistic regression models are used, for which linear probability models will be used. Three different models are tested for the endogenous variables: average time it takes to find your first job; liquid remuneration of the graduate and the current position of the graduate. The results indicate that the variable that most affects the labor insertion is the recommendation of third parties, meanwhile, that for the job positioning is the postgraduate.

Keywords: Insertion and job positioning · Accounting professionals · Econometric modeling

1 Introduction

According to the CEPAL Gender Equality Observatory, in 2015 in Chile, there were about 9 million women of which 79.5% are considered economically active population.

Now, it is not necessarily enough to find work, but also to advance in a positioning, for labor market purposes the difference between position and positioning implies not only the place where the subject is located, but also the recognition that the others subjects make to this location That is, in what job position the subject, salary and characteristics of the person such as communication skills and leadership are located. Through the review of literature, there are several studies that indicate that women do not reach a job position just like men, referring to a topic of self-discrimination and this is mentioned by [1].

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[2] points out that women, even with a more active role, continue to be disaggregated in certain jobs by sex, thus, women have concentrated on specific occupations, many of them linked to providing "feminine" services such as health, education and cleaning. In general, these positions are of less prestige and generate lower salaries [3] while pointing out that there are "feminized" sectors, which are structuring labor insertion patterns for women, limiting the possibility of expanding their employment options.

According to the international labor organization [4] it is possible to see a more active role that women have been having in the labor market, but not in the management cadres where there are still great differences in the hiring of the female labor force. As [3] says well, for someone to achieve a job position, it is necessary for others to recognize power, leadership and other characteristics in that person.

In relation to women's leadership, various studies mention the issue, noting that women have taken the labor market and the direction of many workers within a company, guiding and managing it correctly. The characteristics generally associated with women, such as charisma and social skills, make a difference and form a new model called interactive leadership, taking into consideration some typical features of their condition such as reconciliation and empowerment of their teams based in positive interactions among those involved [5]. Similarly, [6] points out that the factors that positively predict the attitude towards the woman leader are the factors that are linked to attributes that highlight personal competence aimed at the development and progress of the individual, as well as features that emphasize an individual employer focused on personal satisfaction and not group.

The leadership and empowerment has brought about the generation of contact networks or recommendation of third parties, an important and determining factor when starting work. According to [7], they point out that the network of contacts is the main means for obtaining a job, making it the most efficient and fastest means; A large percentage of contracts are made through recommendations from acquaintances. [8] agree with the above, noting that the use of contacts (friends, relatives or unions) by unemployed people as a means to seek employment has grown considerably in recent years, a trend similar to that observed in the whole of the European Union.

However, there is still a small number of women in administrative cadres within companies. Globally, it is observed that only 24% of the top positions of the main private companies are held by women, the highest percentage being that registered in the Philippines with 47%, and the lowest by Japan with 7%. In Latin America this figure is 28%, while Chile is below this average [1].

Even so, existing this tendency of support to begin labor, the difference of gender persists in the labor scope. That is why the question arises. What makes today continue to prefer to hire a man in a certain job, over a woman? The answer is simple and this is indicated by the National Statistics Institute [9]; It can be explained by sexual division of labor, the responsibilities of domestic and family care are socially assigned to women, which limits them with respect to the time they have available and that their employers believe they can devote to paid work. Thus, the conjugation of the domestic and labor spheres becomes complex for some women, producing difficulties in terms of female insertion in public spaces. According to [10], the employer is looking for an employee that generates a lower cost of hiring, which is why the possibility of hiring a woman

of childbearing age is ruled out, since this can at any time get pregnant and trigger endless of expenses by the employer. According to [11], there are 3 barriers that prevent women from reaching high levels of leadership, such as social barriers, where the level of leadership that women can have is mainly questioned. At the same time there are internal barriers, which are those imposed by companies to assign high command to women and finally, there are government barriers, which mention the lack of laws by states to promote the labor positioning of the female gender.

This also brings a salary gap, since on average, the gaps identified in these studies are between 27% and 31%. That is, they earn between 27% and 31% less than their male peers of similar characteristics [9]. Meanwhile, according to a study conducted at the Universidad del Bío-Bío, the salary gap of graduates of the Public Accountant and/or Auditor career is 18% which means that women earn 82% of what that men earn for this profession [12].

However, the factors of increase in the participation rate of women, as mentioned by the [9] can be understood as any substantive change that must be based on concrete facts, which is why the increase in the labor participation rate feminine does not happen by chance. According to the research carried out by this agency, it determines three causes, the increase in the years of schooling of women, the outsourcing of economic activity and the demographic transition.

Particularly in Chile, everything related to the female gender and its insertion in the labor market has been given enough relevance, thus creating, in March 2015, under Law 20.820, the Ministry of Women and Gender Equality.

However, the Public Accountant and Auditor career has been taught since 1982 at the Universidad del Bío-Bío, Chile. The first substantial change in its curriculum occurred in 2003, and subsequently in 2013, the curriculum was reformulated, to the version currently maintained.

Thus, the objective of this research is to determine the variables that affect the insertion and job positioning of the Public Accountant and Auditor of the Universidad del Bío-Bío, in executive cadres of Chilean companies.

2 Methodology

The empirical analysis is carried out for a sample of 54 graduates from the Public Accountant and Auditor of the Universidad del Bío-Bío, Chile, between 2007 and 2016. The total population is 268 graduates. A sample composed of three sections was applied to the sample, i) the first one includes general information of the respondent, ii) the second one focused on determining the job placement of graduates and finally, iii) the third one determines the variables that influence Your work positioning. The sample was calculated with a margin of error of 10% and a confidence level of 90%.

In accordance with the objective of the research and the review of the literature, a set of factors is used to evaluate in the sample, the explanatory capacity of the labor insertion variables, measured through the average time it took for the professional to find her first work once titled; and of the labor positioning variable, measured through the use of two proxies variables: i) remuneration, and ii) managerial or head office, both that according to the revised literature would allow to achieve the positioning [13, 14].

In this way, the regressive models include as an endogenous variable the average time it took for the graduate to find her first job; and job positioning. On the other hand, for the regressive modeling the exogenous variables of the model are: i) maternity, third party recommendation and academic performance, for the first model; and ii) maternity, post-graduation, company size, development of extra-program activities and years of work experience, for the second and third models.

3 Results

3.1 Descriptive Analysis

From the descriptive analysis it is possible to observe that in relation to the years of work experience, the majority of the graduates surveyed in the Public Accountant and Auditor career at the Universidad del Bío-Bío, Chile, have less than 5 years of experience; they found work before a year of graduates; In addition, respondents report not having children; they mostly did not need a third party recommendation to find work and their academic performance is declared as good (rating between 5.0–5.9). On the other hand, the respondents mostly state that they have a rather operational job and a liquid remuneration below $2,000,000 Chilean pesos per month. The graduates work mostly in large companies and declare that they have not needed a postgraduate degree to fill the current position, finally the respondents of the Public Accountant and Auditor career at the Universidad del Bío-Bío, Chile, mostly indicate that they did not maintain participation in extra programmatic activities during his university life.

3.2 Econometric Analysis

Regarding the multivariate regressive evaluation, in this case, having a binary dependent variable, these are logistic regression models, for which linear probability models will be used, where the exogenous variables will be the variables described above. Linear probability models are used to predict dichotomous variables given a set of explanatory variables. Binary models in probability use maximum likelihood estimates to assess the probability of belonging to each category. This type of models will allow us to characterize the probability of response of the labor insertion and the positioning of the professionals of the Public Accountant and Auditor of the Universidad del Bío-Bío, Chile [15–17]. The models in their general form are represented by Eqs. 1, 2 and 3.

$$P(TPT = 0/X) = \frac{1}{1 + e^{-(\beta_0 + \beta_1 MAT + \beta_2 RECT + \beta_3 RA)}} \tag{1}$$

$$P(REML = 0/X) = \frac{1}{1 + e^{-(\beta_0 + \beta_1 AEL + \beta_2 MAT + \beta_3 TE + \beta_4 POST + \beta_5 AEP)}} \tag{2}$$

$$P(CA = 0/X) = \frac{1}{1 + e^{-(\beta_0 + \beta_1 AEL + \beta_2 MAT + \beta_3 TE + \beta_4 POST + \beta_5 AEP)}} \tag{3}$$

For the labor insertion model (Eq. 1), where the endogenous variable corresponds to the average time it took for the professional to find her first job once graduated, it

is possible to observe an adequate percentage of classification of observations (92.6%), which indicates that the model is good for predicting, that is, for future classifications the model should maintain the same success rate. On the other hand, the model presents R-squared Pseudo values of: Cox & Snell R Square = 0.142 and Nagelkerke R Square = 0.347, and a Hosmer and Lemeshow fit test value of: Chi-Square = 2,315, p-value = 0.940; So we can point out that what we observe fits sufficiently with what is expected under the model.

For the labor positioning model (Eq. 2), with an endogenous liquid remuneration variable, it is possible to observe an adequate percentage of classification of observations (94.4%), which indicates that the model is good for predicting, that is to say for future classifications the model would maintain the same success rate. On the other hand, the model presents R-squared Pseudo values of: Cox & Snell R Square = 0.268 and Nagelkerke R Square = 0.652, and a Hosmer and Lemeshow fit test value of: Chi-Square = 0.199, p-value = 0.990; So we can point out that what we observe fits sufficiently with what is expected under the model.

Finally, and for the labor positioning model, with endogenous variable managerial or head office, it is possible to observe an adequate percentage of classification of observations (81.5%), which indicates that the model is good to predict. On the other hand, the model presents R-squared Pseudo values of: Cox & Snell R Square = 0.327 and Nagelkerke R Square = 0.459, and a Hosmer and Lemeshow fit test value of: Chi-Square = 6.755, p-value = 0.563; So we can point out that what we observe fits sufficiently with what is expected under the model.

4 Conclusions

Regarding the labor insertion of the auditing accountants of the Universidad del Bío-Bío, Chile, it is possible to conclude that they are inserted in the workplace before one year. However, these professionals have not achieved a job position in their respective jobs, since they mostly have liquid incomes of less than $ 2,000,000 Chilean pesos per month and hold operational positions.

However, once the analysis of the variables that affect the professional insertion of the professional Accountant Auditor has been carried out, it is possible to conclude that the variable that most favorably impacts the probability of finding employment before a year is the recommendation of third parties. If we simulate a particular case for this situation, we can point out that for a graduate without children (MAT = 0), with a third party recommendation (RECT = 1) and with Acceptable Academic Performance (RA = 0), the probability that the time of Labor insertion exceeds one year is 20%.

Regarding the probability of having a liquid income greater than $ 2,000,000 Chilean pesos per month, it is concluded that the variable that significantly affects the postgraduate of professionals. If we simulate a case for this situation, we can point out that for a graduate with more than 6 years of work experience (AEL = 1), without children (MAT = 0), who works in a large company (TE = 2), with a Postgraduate (POST = 1), and with extra programmatic activities during your university life (AEP = 1), the probability of having a liquid income greater than $ 2,000,000 per month is 67%. However, to obtain managerial positions it was not possible to verify a variable that had a significant impact on the probability of occurrence.

Regarding the positioning of the audit accountants, it is recommended for subsequent studies to extend the years of study, being as much as possible 20 or 30 years in which it is possible to define more precisely whether or not there really is positioning within the professionals.

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References

1. Gallegos Pereira, F., Guzmán Garrido, J., Saavedra Cubillos, C., Silva Hidalgo, A.: Participación de mujeres en cargos gerenciales: una investigación cualitativa de empresas financieras. Tesis de Grado, Universidad de Chile, Santiago (2012)
2. Wainerman, C.: Mercado de trabajo, familias y género. El Sostén de los hogares: trabajo participación y relaciones de género. Centro de Documentación en Políticas Sociales, GCBA. Buenos Aires: Ateneo (2003)
3. Carrillo Montoya, T., Audelo López, C., Escobar Chávez, A., López Leyva, S.: Posicionamiento laboral de la población en situación de rezago educativo en la industria alimentaria, en Sinaloa, México. Persona y Sociedad, XXX **1**, 41–62 (2016)
4. Panorama Laboral 2009 de América Latina y el Caribe. Organización Internacional del Trabajo (2009)
5. Contreras Torres, F., Pedraza Ortiz, J., Mejía Restrepo, X.: La mujer y el liderazgo empresarial. Diversitas: Perspectivas en Psicología **8**(1), 183–194 (2012)
6. Riquelme Vigueras, A., Rivera Aragón, S., Díaz Loving, R.: La instrumentalidad y expresividad en la percepción hacia la mujer con éxito. Acta de Investigación Psicológica **4**(1), 1430–1445 (2014)
7. Cuadrado, I., Morales, J.: Algunas claves sobre el techo de cristal en las organizaciones. Revista de Psicología del Trabajo y de las Organizaciones **23**(2), 183–202 (2007)
8. Verd Pericàs, J., Yepes Cayuela, L., Vacchiano, M.: Trayectorias laborales y capital social en la población joven. Elementos para analizar la precariedad laboral juvenil más allá de los grandes focos. Anuario IET de trabajo y relaciones laborales **3**, 144–158 (2016)
9. Instituto Nacional de Estadística (INE): Encuesta Nacional de Empleo, p. 2019. Estadísticas trimestrales, Santiago (2019)
10. Jackson, J., O'Callaghan, E.: What do we know about glass ceiling effects? A taxonomy and critical review to inform higher education research. Res. High. Educ. **50**(5), 460–482 (2009)
11. Abramo, L.: ¿Inserción laboral de la mujer en américa latina: una fuerza de trabajo secundaria? Estudios Feministas, Florianópolis **12**(2), 224–235 (2004)
12. Rodríguez Quezada, E., Gallegos Muñoz, C., De la Fuente-Mella, H.: Econometric modeling of wage discrimination towards women in the accounting profession. In: Springer, C. (Ed.) International Conference on Applied Human Factors and Ergonomics, pp. 232–239 (2019)
13. Paz, A., de la Fuente-Mella, H., Singh, A., Conover, R., Monteiro, H.: Highway expenditures and associated customer satisfaction: a case study. Math. Probl. Eng. **2016**(4630492), 1–9 (2016)
14. Coughenour, C., Paz, A., de la Fuente-Mella, H., Singh, A.: Multinomial logistic regression to estimate and predict perceptions of bicycle and transportation infrastructure in a sprawling metropolitan area. J. Public Health **38**(4), 401–408 (2016)
15. de la Fuente-Mella, H., Navarro, M.M., Reyes, M.J.: Análisis de la satisfacción universitaria en la Facultad de Ingeniería de la Universidad de Talca. Ingeniare. Revista Chilena de Ingeniería **18**(3), 350–363 (2010)

16. Clark, S., Coughenour, C., Bumgarner, K., De la Fuente-Mella, H., Reynolds, C., Abelar, J.: The impact of pedestrian crossing flags on driver yielding behavior in Las Vegas, NV. Sustainability **11**, 4741, 8 (2019). https://doi.org/10.3390/su11174741
17. de la Fuente-Mella, H., Rojas, J.L., Leiva, V.: Econometric modeling of productivity and technical efficiency in the Chilean manufacturing industry. Comput. Ind. Eng. (2019). https://doi.org/10.1016/j.cie.2019.04.006

Correlation Situation Forecasting of Economic Indicators Based on Partial Least Squares and Kernel Method Regression Model

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Abstract. Accurate prediction of the development trend of various macroeconomic indicators can provide effective support for scientific government decision-making and accurate social governance. Based on the limitations of current macroeconomic big data statistics, it is a formidable challenge to establish accurate and robust prediction models using small samples with high characteristic dimensions. Based on copula-based Granger analysis, we analyzed the relationship between macroeconomic indicators and extracted low-dimensional features of data by combining independent component analysis and partial least square method. On this basis, we further use the kernel function method to complete the virtual sample training set to train the support vector regression model to predict the macroeconomic indicators and obtain better experimental results.

Keywords: Macroeconomic indicators · Virtual samples · Kernel method · Support vector regression

1 Introduction

With the further development of macroeconomic theory, macroeconomic forecasting has become an important aspect of empirical analysis. Scholars use government statistics or web data to find the relationship of economic data through specific models and methods. The prediction methods that use this relationship to predict future macroeconomic indicators have achieved significant results. Limited by the lack of current statistical data release, less data is collected. How to accurately predict the trend of various macroeconomic indicators with small sample data becomes a challenge. This article analyzes the causal relationship between various macroeconomic indicators to obtain time series data with strong correlation indicators and target indicators and builds a model to predict the trend of macroeconomic indicators. However, this poses a problem. When there are multiple indicators with strong causality, the sample feature dimension of the data will be too high, causing a curse of dimensions [1].

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To overcome this challenge, several relevant researchers have designed and developed many methods to improve the accuracy of the forecasting models based on small sample. The current methods can be separated into three categories: (1) gray forecasting model: this model uses the accumulating generation operator (AGO) of the gray theory to deal with raw sample for improving the accuracy. Such as: GM(1, 1) [2], BGM(1, 1) [3], GBM [4], ANGM [5]; (2) virtual sample generation (VSG): this method improves the prediction performance of the model by adding newly generated virtual samples [6–9] to fill the information gap between original samples; (3) feature extraction: feature extraction aims to get most useful information by constructing a lower-dimensional feature space with the existing feature parameters of sample. It can ignore the redundant and irrelevant information. This method is suitable for cases with small sample sizes but high feature dimensions [10–13].

However, achieving the goal with only one measure when the size of sample is very small. Therefore, the combination of feature extraction and virtual sample construction is considered. Among the methods of feature extraction, principal component analysis (PCA) [14] and partial least squares (PLS) [15] are commonly used. PCA is difficult to obtain ideal low-dimensional features when the sample size is small. While PLS has a unique advantage in processing small samples, it can obtain low-dimensional data with strong explanatory power that fully consider the correlation levels of characteristic variables and dependent variables. Since independent component analysis (ICA) can discover more hidden information, we combine ICA and PLS to obtain more representative low-dimensional features. Because the kernel method can improve the linear separability of the sample and maintain the relevant geometric features of the sample. We build virtual samples based on kernel space. Usually, the sample form mapped to kernel space is more complicated, so we build virtual samples based on the kernel function values between samples. In small sample prediction, the performance of support vector regression (SVR) is better than ARIMA, ANN and other models, so we use SVR as a prediction model for final prediction.

2 Methods

2.1 Experimental Data

In this article, we use macroeconomic indicator data from 2009 to 2018 to predict the development trend of macroeconomic indicators. As the data is not complete, we obtain a linear relationship between the indicators through causal analysis and fill the missing data through the relationship. The data from 2009–2016 are used as training samples. The sample features are historical data of various macroeconomic indicators, so we set the maximum number of lag terms to 3. Therefore, the training sample is only five sets of data from 2012–2016. We use two sets of samples from 2017 and 2018 as test cases to verify the effectiveness of the proposed method. We use $\{X_1, X_2, \ldots, X_n\}$ to represent the macroeconomic indicators we want to analyze and predict.

2.2 Causal Analysis

Granger causality is a statistical measure of the effect of direction between two time series. Because macroeconomic indicators have not only linear causality but also nonlinear causality, we analyze the causality between macroeconomic indicators by copula-base Granger causality, without explicit models, for detecting nonlinear, high-order causality. The Granger causality measure is written as:

$$\begin{aligned} GC_{X\to Y} &= E\left[log\frac{f\left(y_{t+1}|y_t^n, x_t^m\right)}{f\left(y_{t+1}|y_t^n\right)}\right] \\ &= E\left[log\frac{h\left(y_{t+1}, x_t^m|y_t^n\right)}{f\left(y_{t+1}|y_t^n\right)\times g\left(x_t^m|y_t^n\right)}\right], \end{aligned} \tag{1}$$

Where h is the conditional joint density of (X, Y), f and g correspond to the conditional marginal densities of Y and X, respectively. According to the Sklar's theorem [16] and its application to conditional copula [17], the conditional joint density h. n be further written in terms of a conditional copula density function c as follows:

$$h\left(y_{t+1}, x_t^m|y_t^n\right) = f\left(y_{t+1}|y_t^n\right) \times g\left(x_t^m|y_t^n\right) \times c\left(u, v|y_t^n\right) \tag{2}$$

Where $u = F\left(y_{t+1}|y_t^n\right)$ and $v = G\left(x_t^m|y_t^n\right)$. F and G represent the condition marginal distributions of X and Y, respectively. Thus, substituting Eq. (2) in Eq. (1), we obtain Granger causality of $X \to Y$ in a simple form as follows:

$$GC_{X\to Y} = E\left[logc\left(F\left(y_{t+1}|y_t^n\right), G\left(x_t^m|y_t^n\right)|y_t^n\right)\right] \tag{3}$$

2.3 Feature Extraction

The purpose of the feature extraction is to use the existing feature parameters of sample to construct a lower-dimensional feature space. PLS can get ideal low-dimensional features which completed the principal component analysis, canonical correlation analysis, and linear regression analysis during the modeling process. ICA was originally proposed for isolating independent source signals from linearly mixed signal [18], More useful information hidden in macroeconomic indicators can be obtained by ICA. In order to obtain more representative low-dimensional features, we combine ICA and PLS to feature extraction. The PLS algorithm is introduced as follow.

Suppose there are n variables $\{x_1, x_2, \cdots, x_n\}$, m variables $\{y_1, y_2, \cdots, y_m\}$. After preprocessing, matrix X and Y are decomposed into:

$$\begin{cases} X = TP^T + E \\ Y = UQ^T + F \end{cases} \tag{4}$$

Where T and U are the score matrix of X and Y, respectively. P and Q are the load matrix of X and Y, respectively. E and F are respectively the residual error matrix of X and Y. Matrix multiplication of TP^T can be expressed as the sum products of score

vector t_i (the i^{th} column of matrix T) and load vector p_i (the i^{th} column of matrix P), and UQ^T is similar to TP^T then the above formula can be written as:

$$\begin{cases} X = \sum_{i=1}^{n} t_i p_i^T + E \\ Y = \sum_{j=1}^{n} u_j q_j^T + F \end{cases}, \mathrm{i, j} = 1, 2, \cdots, \mathrm{n} \tag{5}$$

PLS analysis is the score t and u separately extracted from corresponding X and Y. The formula for obtaining the score matrix T is as follows:

$$T = \mathrm{X} \cdot W\left(P^T W\right)^{-1} \tag{6}$$

Where W is the weight matrix. In general, we do not need to select the r components $t_1, t_2, \ldots, t_r$ that exist when we build a regression model. The number l of components required for modeling can be determined by cross validity test.

2.4 Virtual Sample Generation

It can be known that solving the SVR model only needs to obtain the kernel function value between the samples. We build the virtual samples with the kernel function of the virtual sample and other samples. The details are as follows:

First, using the median of two samples in a high-dimensional space as the new sample can be expressed as:

$$v = 1/2\varphi(x_i) + 1/2\varphi\left(x_j\right). \tag{7}$$

Where $\boldsymbol{v}$ is a virtual sample generated based on the high-dimensional space samples $\varphi(x_i)$ and $\varphi\left(x_j\right)$. We can obtain the kernel function values of the virtual sample and other sample:

$$K(v, \varphi(x)) = 1/2K(\varphi(x_i), \varphi(x)) + 1/2K\left(\varphi\left(x_j\right), \varphi(x)\right) \tag{8}$$

Assuming that the kernel matrix of the original training sample is $K_{n\times n}$, it can be concluded that the kernel matrix after adding virtual samples is:

$$K_{(n+1)\times(n+1)} = \begin{bmatrix} K_{n\times n} & K(\varphi(x_1), v) \\ & \vdots \\ K(v, \varphi(x_1)) \cdots & K(v, \varphi(x_n)) \end{bmatrix}. \tag{9}$$

The specific operation of forecasting macroeconomic indicators is as follows: first we get the causal relationship between the indicators through copula-base Granger causality to obtain samples, its manifestation is $\left(X_y, y\right)$, where $X_y = \left\{x_i^1, x_i^2, \ldots, x_i^r, \ldots, x_m^1, x_m^2, \ldots, x_m^d\right\}$, x_i represents i^{th} indicator.r, d respectively represent the number of lagging terms of x_i and x_m which have strong correlation with indicator y. Then we use the above method to make predictions. The schematic description is as follows (Fig. 1):

The specific algorithm steps are as follows:

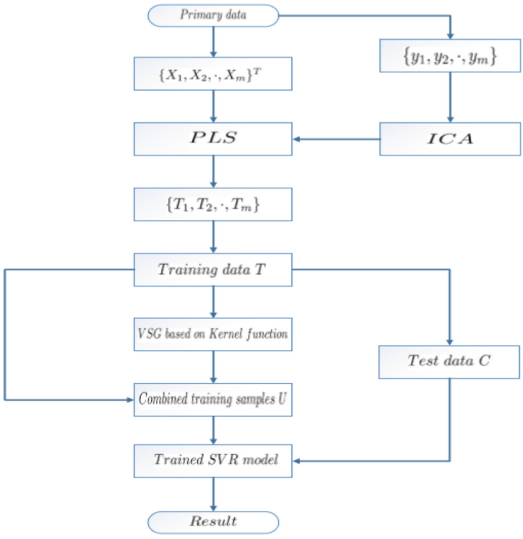

Fig. 1. Schematic description of proposed forecasting model.

(1) Normalize index data and analyze the causality between various indicators through the copula-based Granger causality measure;
(2) Partial least squares method and independent component analysis method are used to extract the features of the samples to reduce the dimensions of the sample features and solve the collinearity problem of features;
(3) Use the kernel method to construct virtual samples;
(4) Use the combined sample set to train the support vector regression model and predict the indicators to get the results.

3 Result Analysis

In this article, we use the proposed method to predict the trend of macroeconomic indicators in 2017 and 2018 and compare them with real values to obtain Tables 1.

Table 1. Real and predicted values of smooth macroeconomic indicators

	Indicator	X_1	X_2	X_3	X_4	X_5	X_6	X_7	X_8	X_9	X_{10}
real	2017	7.9	9.3	12.3	12.4	13.8	14.1	15.1	20.5	27.6	7.8
	2018	7.8	9.2	12.3	14.1	14.3	13.6	15.1	21	23.2	7.8
pre	2017	7.9	8.3	12.4	12.3	14.2	12.9	15.3	22.8	26.6	7.9
	2018	7.9	9.1	12.3	12.9	14.8	13	15.5	21	24.9	8

We can see in Tables 1 that the fluctuations in the data are small. Our proposed method can make accurate predictions for a considerable number of macroeconomic

indicators. When the sample data is relatively small and stable, our method can more accurately predict the development trend of the indicators; as the sample fluctuations become larger, accuracy will decrease accordingly, like Table 2.

Table 2. Real and predicted values of fluctuating macroeconomic indicators

	Indicator	X_{11}	X_{12}	X_{13}	X_{14}	X_{15}	X_{16}
real	2017	4.3	4.4	40	13	9.8	15.1
	2018	3.2	8.6	28	11.1	11.4	13.8
pre	2017	4.4	4.8	37.1	15.1	14.5	14.4
	2018	4.3	5.3	36.3	15.3	14.5	16.3

From the results in the above two tables, we can also see that the two predicted values obtained are not much different, which indicates that the proposed method does not discriminate the samples very much, among which there are parameters of the support vector regression model, But mainly due to insufficient samples.

4 Conclusion

In this work, through the analysis of granger causality analysis, we understand the internal relationship between various macroeconomic indicators, a combination of ICA and PLS has been proposed to extract important features of sample. We also use the kernel function method to construct a virtual sample by linearly transforming the kernel function values between samples, which greatly improves the prediction accuracy. At the same time, we encountered some problems during the experiment, such as the problem of overfitting. Due to the small size of sample, and when the virtual samples are constructed, not only filling some lost information, but also increasing the severity of overfitting; In addition, some macroeconomic indicators are greatly affected by policies, and simply using historical data cannot accurately predict their development trends. Therefore, in the next work, we need to find ways to solve the problem that the construction of virtual samples will make overfitting worse, and consider non-data factors such as national policies into the work. We hope to get better results.

References

1. Korn, F., Pagel, B.U., Faloutsos, C.: On the "dimensionality curse" and the "self-similarity blessing". IEEE Trans. Knowl. Data Eng. **13**(1), 96–111 (2001)
2. Zhao, D., Gao, C., Zhou, Z., et al.: Fatigue life prediction of the wire rope based on grey theory under small sample condition. Eng. Fail. Anal. **107**, 104237 (2020)
3. Chang, C.J., Li, D.C., Huang, Y.H., et al.: A novel gray forecasting model based on the box plot for small manufacturing data sets. Appl. Math. Comput. **265**, 400–408 (2015)
4. Wang, Y., Wang, Z., Sun, J., et al.: Gray bootstrap method for estimating frequency-varying random vibration signals with small samples. Chin. J. Aeronaut. **27**(2), 383–389 (2014)

5. Chang, C.J., Li, D.C., Chen, C.C., et al.: A forecasting model for small non-equigap data sets considering data weights and occurrence possibilities. Comput. Ind. Eng. **67**, 139–145 (2014)
6. Yang, J., Yu, X., Xie, Z.Q., et al.: A novel virtual sample generation method based on Gaussian distribution. Knowl.-Based Syst. **24**(6), 740–748 (2011)
7. Li, D.C., Wen, I.H.: A genetic algorithm-based virtual sample generation technique to improve small data set learning. Neurocomputing **143**, 222–230 (2014)
8. Gong, H.F., Chen, Z.S., Zhu, Q.X., et al.: A Monte Carlo and PSO based virtual sample generation method for enhancing the energy prediction and energy optimization on small data problem: An empirical study of petrochemical industries. Appl. Energy **197**, 405–415 (2017)
9. He, Y.L., Wang, P.J., Zhang, M.Q., et al.: A novel and effective nonlinear interpolation virtual sample generation method for enhancing energy prediction and analysis on small data problem: a case study of Ethylene industry. Energy **147**, 418–427 (2018)
10. Zhang, J., Jiang, Z., Wang, C., et al.: Modeling and prediction of CO_2 exchange response to environment for small sample size in cucumber. Comput. Electron. Agric. **108**, 39–45 (2014)
11. Dernoncourt, D., Hanczar, B., Zucker, J.D.: Analysis of feature selection stability on high dimension and small sample data. Comput. Stat. Data Anal. **71**, 681–693 (2014)
12. Espezua, S., Villanueva, E., Maciel, C.D., et al.: A Projection Pursuit framework for supervised dimension reduction of high dimensional small sample datasets. Neurocomputing **149**, 767–776 (2015)
13. Jia, W., Zhao, D., Ding, L.: An optimized RBF neural network algorithm based on partial least squares and genetic algorithm for classification of small sample. Appl. Soft Comput. **48**, 373–384 (2016)
14. Wold, S., Esbensen, K., Geladi, P.: Principal component analysis. Chemometr. Intell. Lab. Syst. **2**(1–3), 37–52 (1987)
15. Wang, H.: Partial Least-Squares Regression-Method and Applications, pp. 202–206. National Defense Industry Press, Beijing (1999)
16. Sklar, A.: Random variables, joint distribution functions, and copulas. Kybernetika **9**(6), 449–460 (1973)
17. Granger, C.W.J., Teräsvirta, T., Patton, A.J.: Common factors in conditional distributions for bivariate time series. J. Econom. **132**(1), 43–57 (2006)
18. Jutten, C., Herault, J.: Blind separation of sources, part I: an adaptive algorithm based on neuromimetic architecture. Sig. Process. **24**(1), 1–10 (1991)

Work and Task Design

Toward Improving the Direction Orientation Task

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Abstract. The Direction Orientation Task (DOT) was developed as a test of spatial ability and processing speed. It is used by several US military services as part of their respective cognitive selection batteries for military aviators. Previous attempts to improve the task exposed an additional concern: specifically, the majority of participants were applying a mathematical strategy to the task, and these participants were outperforming those using a spatial strategy. This paper discusses the development of a newer version of the DOT designed to push participants towards using a spatial strategy. A group of student Naval Aviators completed the new version and were more than twice as likely to employ a spatial strategy compared to a math strategy. Because the original DOT is the only measure of spatial ability currently used to select naval aviation candidates, additional testing should assess whether it is actually measuring the desired construct.

Keywords: Aviation · Selection testing · Spatial ability

1 Introduction

Spatial ability (SpA) if considered an important skill required for success in many professions such as architecture, aviation, and surgery. The most widely used research definition of SpA is Lohman's [1] "the ability to generate, retain, retrieve, and transform well-structured visual images whose properties include location, size, distance, direction, separation, connection, shape, pattern, and movement." The importance of SpA for military aviation was identified based on selection testing during World War II [2]. At that point spatial ability was still a new construct born from factor analytic research of Thurstone [3]. The US military's [2] early selection work discussed several paperbased

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spatial ability measures (e.g., determining the planes' orientation given a view of the horizon).

Modern selection tests for military pilots are computer-based. The Test of Basic Aviation Skills (TBAS) is used by the US Air Force, and the Aviation Selection Test Battery (ASTB) is used by the US Navy, Marine Corps, and Coast Guard to identify which applicants to accept to their respective aviation programs. Both batteries use some of the same measures of cognitive ability, including the same measure of SpA: the direction orientation task (DOT) [4]. The DOT has examinees determine orientation of an object as viewed from a forward-facing camera of an Unmanned Aerial Vehicle (UAV) flying along a fixed heading. In the original DOT, participants are asked to identify one of four parking lots (North, South, East, or West), as though it is seen from the vehicle's forward facing-camera feed (see Fig. 1 for example). The ability for pilots to understand the spatial orientation of objects on the ground from an outside aerial view is important in real world operations. The test has face validity, and early evaluators even state "the relevance of this test should be clearly apparent" [4].

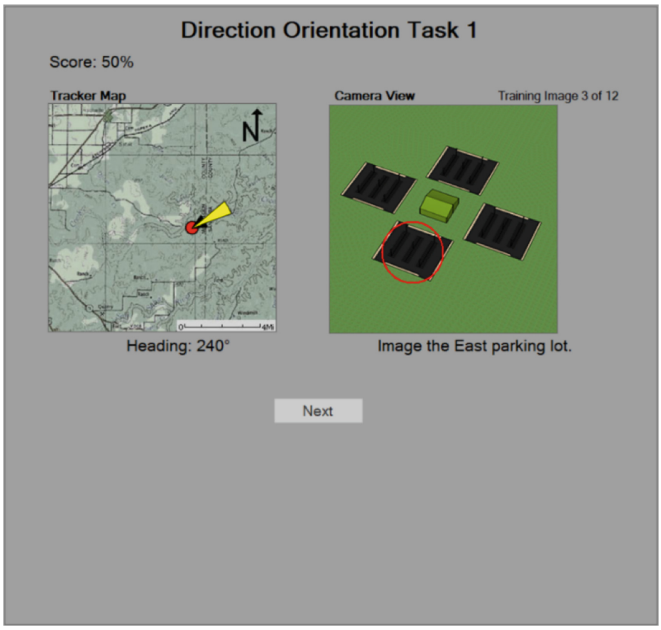

Fig. 1. Sample from the original Direction Orientation Task with the mouse (red circle) over the correct answer.

There are several limitations of this test, including a significant practice effect (improvements in both speed and accuracy) when students take the DOT within 24 h [5]. Other limitations of the DOT include a limited number of potential trials (48) and a ceiling effect [6]. The latter two problems are exacerbated since motivated candidates who are interested in taking the test can find practice trials for the test online, allowing them to memorize all 48 possible trials. An attempt to make the DOT more difficult (i.e.

DOT 2), showed some initial positive results [6]. The resulting DOT 2 has 144 possible trials and reduced the chance of successfully guessing. Instead of selecting among four parking lots, participants select among one of twelve possible headings that a ship in the camera view is facing (see Fig. 2). However, subsequent research on the DOT 2 surveyed participants about the strategy they employed during the task and found that on average participants reported using a math strategy 65% of the time and a spatial strategy only 31% of the time. Even more problematic was that strategy use significantly correlated with performance. The correlation between the reported amount of time spent using a math strategy and performance on the task was $r = .74$, and the amount of time spent using a spatial strategy was negatively correlated with performance ($r = -.65$). This suggests that the construct measured by the DOT 2 might not actually be spatial ability, but rather the application of a relatively simple formula. One mathematical solution to DOT 2 is to add the UAV's heading with the apparent heading of the ship (and then to subtract 360 if the sum is over 360°). While the strategy results were only obtained in the updated version of the DOT, it is plausible the same mathematical solution was used on the original version. This suggests that the only measure of SpA used to identify military pilots may not actually be measuring the construct that they were intending to assess.

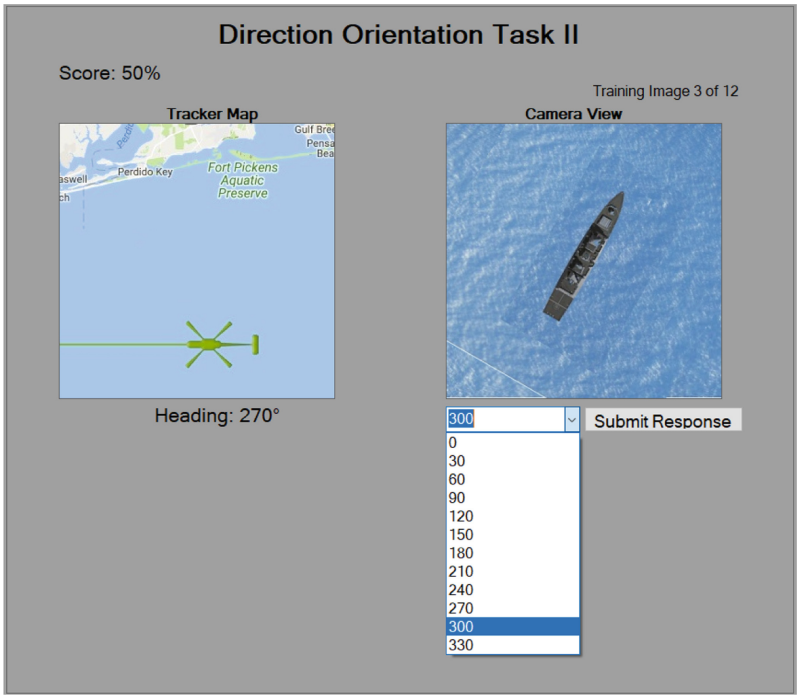

Fig. 2. Sample trial from the Direction Orientation Task 2. Participants would select an answer from the drop-down menu. The correct answer here is 300.

The goal of this paper is to test a modified version of the DOT 2 task, named the DOT 2.5. The DOT 2.5 (see Fig. 3) makes the application of a math strategy somewhat

harder. We removed the UAV's heading, and instead forced participants to look at the map to determine the heading. The responses are no longer made with a drop-down menu of numeric headings, but instead are performed on a visual representation of a compass with the cardinal directions listed. The same formula can still be applied, but it is less apparent as no numbers are provided. Further, to help reduce the learning effect, the number of practice trials was doubled, and the number of experimental trials was reduced by half. The goal of this newer version of the DOT was to push participants towards using a spatial strategy because SpA is the underlying construct of interest.

2 Method

2.1 Participants

Eighty student Naval Aviators (13 Female) participated in this study. The mean age was 23.79 ($SD = 1.99$). The data were collected in a small classroom where up to 14 participants completed the same protocol at the same time. The protocol was approved by Naval Research Laboratory's Institutional Review Board.

2.2 Direction Orientation Task (Version 2.5)

The Direction Orientation Task 2.5 (DOT 2.5) (see Fig. 3) is similar to the original Direction Orientation Task (DOT) and the DOT 2 in that the individual's task is to assume they are flying an Unmanned Aerial Vehicle (UAV) traveling along a fixed heading (the left image in Fig. 3 depicts the UAV's heading). The task is to view imagery (the right image in Fig. 3) from a forward-facing camera on the UAV and interpret the actual orientation of that imagery based upon the UAV's heading. Within the DOT 2.5 (and DOT 2), the camera imagery depicts a ship pointed in one of twelve possible orientations. From the example in Fig. 3, if the UAV is heading west north west (300°) and the imagery on the right shows the ship pointed towards the left (9 o'clock position), then the ship is actually traveling on a heading of 210°. Participants then respond using a compass wheel (see the bottom of Fig. 1). Another example is if the ship on the right is facing straight up (12 o'clock) it is traveling on the same heading as the UAV. Two of the big changes from the DOT and DOT 2 tasks is the new version does not explicitly state the UAV's heading, and the response is no longer numeric.

The DOT 2.5 begins with self-paced instructions which provide worked examples and stress the importance of both speed and accuracy on the task. After the instructions, participants completed 24 practice trials in which they were given feedback on their performance. The practice trials were the same for all participants and organized from "easy" to "hard", based upon item performance analysis from previous DOT 2 data. Generally, the easy trials had the ship traveling North or at the three other cardinal directions. After the practice trials, participants have to complete 24 test trials in which there was no feedback.

Following the completion of the DOT 2.5, participants were asked to complete a survey about the task. The survey asked what percentage of questions they believed they answered correctly, whether they used a strategy, whether they switched strategies, and a fourth question asking what proportion of the time they used a Math, Spatial, Guessing, or Other strategy to solve the task.

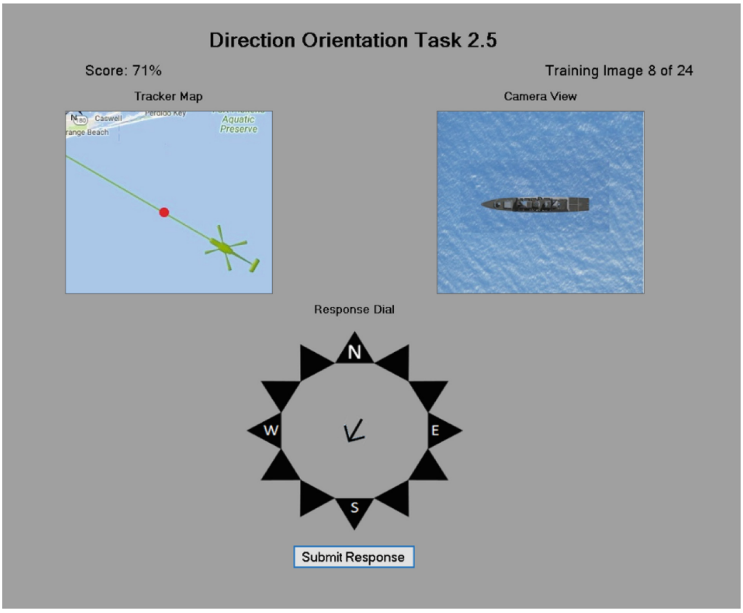

Fig. 3. The Direction Orientation Task (version 2.5), with the correct answer selected on the response dial.

2.3 Procedure

Participants also completed a series of other tasks that are not part of this paper. This included calibrating and testing the accuracy of an attached eye tracking device prior to the completion of the DOT 2.5. After the DOT 2.5 they also did an antisaccade task and a short UAV simulation. The overall duration of the experiment was approximately 90 min with the DOT 2.5 trials within the first 25 min.

3 Results

Participants answered 64.27% ($SD = 4.79\%$) of the trials correctly during the 24 practice trials and 68.42% ($SD = 4.65\%$) of the trials correctly during the 24 regular trials. Figure 4 shows the accuracy histograms for both the practice and regular trials.

Performance did not improve across trials and the response time slowed. Accuracy was not correlated with trial number and median response time was positively correlated with trial number ($r = 0.701$, $p < .001$).

The results from the DOT 2.5 strategy questions revealed that, on average, participants reported using a Math strategy 26.12% ($SD = 31.99$) of the time and a Spatial strategy 57.5% ($SD = 31.07$) of time. There was a small positive correlation ($r = 0.318$, $p < .001$) between the percentage of time a participant reported using a math strategy and their overall accuracy on the regular trials. The reported use of a spatial strategy and DOT 2.5 performance was not significantly correlated.

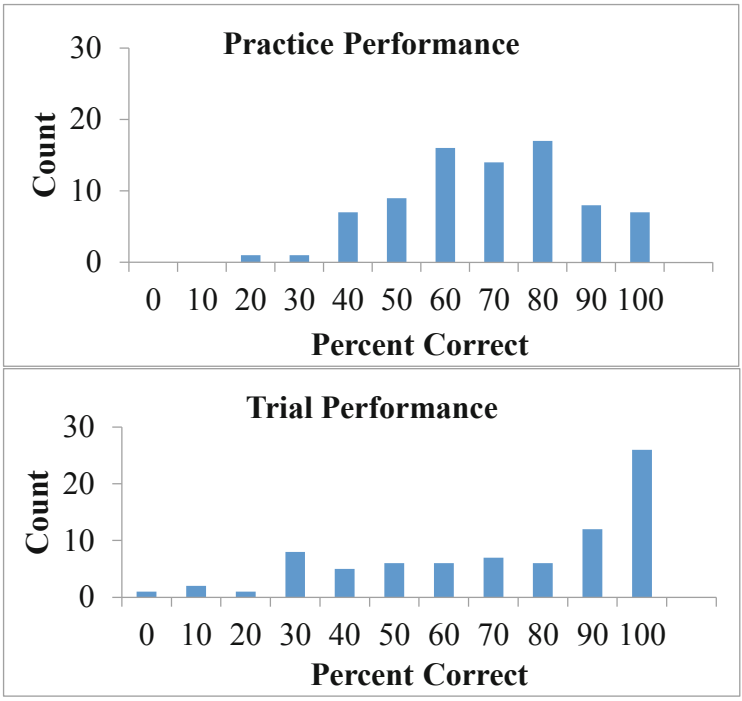

Fig. 4. Histograms for accuracy on the DOT 2.5 during the practice (A) and the regular trials (B)

4 Discussion

The initial results for the DOT 2.5 are mixed. Unlike an earlier revision to the DOT (DOT 2) [6, 7] the results from this study indicated that participants reported using a spatial strategy more than twice as often as they reported using a mathematical strategy. The primary issue with the DOT 2 was that participants were more likely to use a math strategy than a spatial one. Given that the DOT is meant to assess SpA it is important that participants taking the task report using a spatial strategy. However, similar to the results from the DOT 2, the percentage of time participants reported using a math strategy was positively correlated to their performance on DOT 2.5. This correlation was only a moderate one ($r = .32$) compared to previous results from DOT 2 [7] which found a strong correlation ($r = .74$). However, it is important to note that the current study looked at the performance of student Naval Aviators, a population who have been down-selected on cognitive ability including SpA as measured by the original DOT. This population thus has less variability than the population in the DOT 2 strategy study which looked at Army cadets. The lack of variability, i.e. restriction of range, could be what is driving the correlation down. Further research should look at DOT 2.5 performance in a more variable population.

While the self-reported strategy survey is helpful, it is limited to what participants are aware they are doing, and the provided strategies may bias their responses. Despite the limitations of self-report for assessing strategy, this technique would be informative

if it were also applied to the original DOT. This assessment has not been conducted, but will be in follow on research, since the same mathematical approach can be used in all three versions of the DOT. It is unclear, however, if this is the approach the majority of individuals use on the original test.

Comparing the different versions of DOT with other more established measures of spatial ability would be a better way to assess construct validity. The reliance on the test's face validity alone is not sufficient. It is also important to note that even in more established measures of spatial ability, such as paper folding and rotation tasks, the use of analytic strategies instead of spatial ones has been significantly correlated with performance [8]. The use of different strategies in spatial abilities tasks has led Hegarty to argue that we move beyond psychometric tests of spatial ability and towards identifying components of spatial intelligence. Part of her argument is that a flexible application of different strategies is important in many domains. Relatedly, an interesting evaluation may be to train individuals who are not performing well on DOT to solve the trials with a mathematical approach.

The DOT 2.5 was designed to address some of the shortcomings of both the original DOT as well as the DOT 2. While the majority to participants claimed to use a spatial strategy more frequently on the task, only the use of a math strategy was correlated with better performance. The correlation in the current study was weaker than one found with the DOT 2, and it is unclear how prevalent the use of a math strategy in the original version is or if leads to better performance. Even if the DOT 2.5 is the better DOT version, the correlation with a non-spatial strategy and performance may necessitate the identification on an alternate test of SpA.

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References

1. Lohman, D.F.: Spatial ability and G. In: Dennis, I., Tapstield, P. (eds.) Human Abilities: Their Nature and Measurement, pp. 97–116. Lawrence Earlbaum Associates, Mahwah (1996)
2. Guilford, J.P., Lacey, J.I.: Printed classification tests. US Government Printing Office (1947)
3. Thurstone, L.: The Nature of Human Intelligence. McGraw-Hill, New York (1938)
4. Olde, B.A., Walker, P.B.: The automatic pilot examination (APEX): the Navy's online testing system for selecting naval aviators. In: Proceedings of the Human Factors and Ergonomics Society Annual Meeting, pp. 2269–2273 (2006)
5. Momen, N.: The effects of alternative input devices and repeated exposures on the Test of Basic Aviation Skills (TBAS) performance. Mil. Med. **174**, 1282–1286 (2009)
6. Keiser, H.N., Moclaire, C.M., King, K.M., Brown, N.L., Foroughi, C.K., Sibley, C., Coyne, J.T.: Updating the direction orientation task: an aviation selection tool. In: Proceedings of the Human Factors and Ergonomics Society Annual Meeting, pp. 1414–1418. SAGE Publications, Los Angeles (2019)
7. Coyne, J.T., Brown, N.L., Foroughi, C.K., Sibley, C., Rovira, E.: The use of non-spatial trategies in the direction orientation task. In: Proceedings of the Human Factors and Ergonmoics Society Annual Meeting (Submitted)
8. Hegarty, M.: Components of spatial intelligence. Psychol. Learn. Motiv. **52**, 265–297 (2010)

Rethinking the Contemporary Art Fairs Through the Viewpoint of Assemblage Theory: A Case Study of ART021 from Shanghai

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Abstract. Approaching the study of the current over-supply of Contemporary Art Fairs from the viewpoint of assemblage theory is what we explored value within this paper. Base on the literature review of Actor-Network Theory (ANT) that gives us an enlightening vocabulary and framework to approach how Art021 built their business network. We connect the case from contemporary art market to analysis the specific art collaborations. The network assembled a number of galleries, collectors, art media and public attending in a certain location and time to construct various projects, campaigns, and exchange. This study set out with the aim of shaping the co-create interest among different stakeholders and describe their marketing solution during the art fair.

Keywords: Art fair · Assemblage · Actor-Network Theory

1 Introduction

The city where hold a contemporary art fair has grown to be a symbol indicates a sense of global metropolis. The phenomenon increases the attention that whether the specific art fair development stand for describing a mega economic body. What the art market other than different market that support to shape the global metropolis? Well, the art market analysis infers the increased art fairs in worldwide suggest a form of correlation between economic, social and cultural capital. So that we propose to figure out more details about this type of capitalism by utilize Art021 as a case study. We expected more specific business strategies can gives us more evidence to understand the network of wealthy class. More is, it might help us argue how business collaboration with art market connect with the attention economy in China. Either, we might able to indicates an emerging variation of art fair impact on digital world. Dating back to historical art fairs business module, which is depend on macroeconomic conditions such as internationally politically strong government, general economic prosperity, soundly managed economy, a speculative environment and a high standard of living [1].

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We would like to suggest that attention economic is transferring the traditional economic prosperity, which is this paper going to discuss, as one of the significant components to influence art fair's marketing. But how to account for the benefit from economic attention? Well, Attention is a resource, costumers have only so much of it. As an incredible information consumption supplier, "attention" has become the base market for entertainment industry. For instance, Box office used to describe how successful of a film is. As a visual journey to produce and reproduce social life in general, film success is the possibility to win the public attention, an abstract subject for collective and democratic consciousness and hence democratic representation [3], which trans the "attention" to the financial property and make count on that. On the other hand, economic conditions in response to political policy. It is worth to note that the leadership of Shanghai city government yearly visit Art021's opening, which reveals government policies deeply rooted in the art market as well the censorship. What previously established for the background of Art021, it will be detailed by the relevant conversations that insight on how different collaborations cause tension in the art community.

2 Getting the View of Assemblage

For those significant international art fair such as Art Basel at Miami and Hong Kong, Fireze Fairs at London and Los Angeles, thousands of people including art lovers, collectors, gallerists, and art professionals assemble together to a commercial center to run the events. In 2000, there are 55 established international art fairs, but in 2019 we have 285 of the largest international art fairs from a database by Art Basel & UBS report edited by McAndrew [4, 5]. What interesting is, we would like to point out this business module of global art fair just spread smoothly and fast in a global landscape. But how to get know they accomplish the business goals and to secure a competitive position in the market. We propose to approach this phenomenon within the viewpoint of assemblage theory, and it is what we explored value within this paper. The Assemblage Theory rooted in "A Thousand Plateaus (1980)" written by Gilles Deleuze and Felix Guattari. According to DeLanda [2] with the definition of assemblage: "It presented the two aspects: The parts that are fitted together are not uniform either in nature or in origin; assemblage actively links these parts together by establishing relations between them. The assemblage approach suggests a different set of metaphors for the social world: mosaic, patchwork, heterogeneity, fluidity, transitory configuration instead of a static way of thinking an extended social thing." Exploring further how networks are built or assembled and maintained to achieve a specific objective, Latour [6] published an introduction to Actor-Network Theory (ANT), which is a framework and systematic way to consider the infrastructure surrounding technological achievements. From about 1990 onwards, ANT started to become popular as a tool for analysis in a range of fields [7]. Assigns agency to both human and non-human actors [8]. ANT provides a lens to view the role of technology in shaping social processes. It is a conceptual tool and vocabulary that forms the basis for interpreting business strategies. Also, it proves useful to provide a theoretically inform many complex conversations locally and globally.

Several specific approaches have been developed to study humans and their interaction with technology in organizations. As one of the cited theories that pay close attention

to complexity network. We would like to review it through what happens in the net-art world has demonstrated, the success of the art fair is to be seen in its Reconstruction based on the concept of the network. Network refers in this context to three qualities, 1) the art fair is a network as it links up art dealers, professionals, and collectors from distant regions, creating a small-world network, 2) it is a network of mutual observation and 3) it is a network as its results, for instance, related sales or presentation of new talents, sets out criteria for other players in the market, which are thereby drawn into its network and aims to activate the weak ties in the market [4, 5].

According to the Translation and Inscription of ANT, Translation is assumed as an interpretation which can lead to representation of common interests [9]. On the other hand, it is a set of methods by which actors within a network will try to enroll the other actors into positions that can serve their own purposes. An inscription is an act that actors imprint on other actors to shape their attitudes and properties [10]. It is suggested what actors do, why they do it, and their interests or beliefs in doing so through their interactions that support their existence [7]. The inter-organization in social dimension influenced by Actor-Network-Theory, presented the following strategies [10]:

- Identify the network goals.
- Describe the actors in their practice and their relationships.
- Understand how actors can be involved in the network.
- Observe actors can be involved in the network.
- Specify an outline of a negotiation mechanism to align the interests of the actors.
- Include in the business model the social context of the network, as well as of its elements.
- Specify the high-level requirement of the underlying information system", "Multi-flip Networks: Parallelizing GenSAT", "Self-determinations of Man".

3 Types of Network

To construct the selective networks from Art021 art fairs, we considered increasing activation in the understanding of its quality as a platform for sales, formation of prices, creation of further transactions and rarity of the items being traded [5]. There are three typical types of networks that we stress in this section. For each so-called art collaborations, it will give a detailed understanding of how these projects are shaped, as well as best practices between the diverse stakeholders of artists, brands, and creative agencies.

First is the net-art constructed by the three significant actors: private museum, critic-curator and art fair. As the most important buyers in the contemporary art market, what museum purchase and exhibit influence directly to the taste and speculative price of artwork. We have a brief introduction of this private museum, which is funded by China's billionaires Liu Yiqian and his wife Wang Wei. As an initial purpose to establish a private museum that it is the space for them manage remarkable antiques. Long museum rebuilds on an existing 1950s shipping factory beside the Huangpu River. It extended to 110 m in length, 10 m in width, and 8 m height that has a huge space to curate a certain number of both inside and outside exhibitions. Being the renewed industry area, it grows attention on public art engagement as well. Another actor is an award-winning art critic and curator

from U.S.: Barbara Pollack. She connects her new book launch and a curation project within this relationship (Fig. 1).

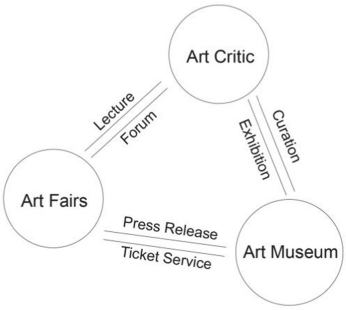

Fig. 1. There are three main actors: private museum, critic-curator and art fair.

Art021 and Long Museum were both benefits in employing this kind of network structure, it is no wonder that both of them open for Pollack to speak with a young generation of Millennials artists from China but lives in the U.S., presenting the "Post-Passport Identity" as their cultural perspective. This lecture was given during the Art021 "Invitation only" day of visiting. Art advise beginning with the independent critic (Pollack's viewpoint) to the art market exposure (Art021 art fair). It indicates one of the solutions that how art producing connects with art market, which besides the wave of dealers and artists market themselves. Meanwhile, the actor of Long museum plays the key role to infer the option made by "collector identity".

Another network consisted by five actors: Celebrity (Film star Sun Li), Shopping Mall (JingAn Kerry Centre), Artist (ChengRan), Chrity agency (Think Adoption), and Art021 fair. It is not surprising that contemporary art fair attends to "selling out", but as the marketplace has been deeply fractured, where has the consensus on what's an appropriate degree of "selling out." Now what common to see corporate agencies and brands in art, getting paid for it doesn't seem as big of a deal [12]. Especially when the collaboration goes for the public interest (Fig. 2).

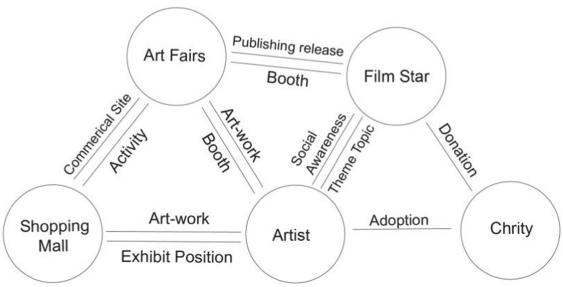

Fig. 2. There are five actors: Celebrity, Shopping Mall, Artist, Chrity agency and art fair.

General speaking, the story-telling starts with the public-art installation: Stray Cat. To align the interests with different actors, this prototype is a city stray cat adopted by artist Chen Ran from the Think Adoption (TA) Charity. The celebrity who is contribute her part-time work to evoke the protection and adoption of Shanghai city stray animals. Art021 funds a specific project called Beyond Extend to support process this kind of network, connecting those actors and contract with JingAn Kerry shopping center to exposure the social caring around animal protection. The movement which involves interpretation, translation, mutation, adaptation, and indigenization as the receiving culture brings its own cultural resources to bear, in dialectical fashion, upon "cultural imports" [11].

The third network suggested three main actors: K11 Shanghai, Artist Katharina Grosse, and Art021. This cooperation set out with the aim of assessing the importance of Artist Branding, which aim to access the transaction between symbolic value and economic value. In particular, K11 is a business entity that combines fashion brands and pop-art gallery space. It stance for a solution when contemporary art faces the marketing desire. Another actor is German artist Katharina Grosse. It is her first solo exhibition in China, landing a new regional art market (Fig. 3).

Fig. 3. There are three main actors: K11, artist and art fair.

As extremely active participators in the geographical art market, what Art021 and K11 presents are significant at least goes for brand-and-brand link up with artist who does a good job on self-branding. It's in the ecosystem of post-sponsorship that pursues a "trending aesthetic" [12]. What interesting is, when we back to read over the Academic Institutional Selection by the Salon monopoly system to support an artist's career life, the artist branding has shifted the initiative back forward to artist themself. We could argue that one of the key points of the Art dealer-and-critic system among them is very likely result in bridge this transaction.

In our discussion in previous net-art examples, we address a crucial component of an actor network: the diagram as we see [2], a variety stakeholders situate the new wave of brand or commerce collaborations in the context of art fair development. What best ANT navigation in our study is let us outline the practice of artists, art institutes, agencies and facilitators engaging in such a project, assembling those actors' interests, tendencies and capacities that are virtual (real but not actual).

4 Discussion

To achieve the common interest that success in the networked business environment, three art collaborations selected to analyze for our potential hypothesis, which is benefit the perspective from Assemblage theory study. Each of them stance for broader possibilities of working together. The result of our case study improves that Institutional relationships and a well-defined project in the reality of a network economy help actors' exposure themselves to the attention market. Art021 base on the organizer and one of Shanghai art business platforms, not just let international art dealers could linkups at a particular location, but also get information about the local art market that leads to introduce the art community, their logic and interaction. Borrowing from the ANT to support the conceptual framework, it moves us up to map their relationship, proceeding the dynamic there to be read.

References

1. Little, D.: Understanding society: assemblage theory. https://understandingsociety.blogspot.com/2012/11/assemblage-theory.html. Accessed 10 Apr 2020
2. DeLanda, M.: Assemblage Theory. Edinburgh University Press, Edinburgh (2016)
3. Beller, J.: The Cinematic Mode of Production: Attention Economy and the Society of the Spectacle. UPNE (2012)
4. McAndrew, C.: The art basel and UBS global art market report. Art Basel. https://www.artbasel.com/about/initiatives/theartmarket?gclid=Cj0KCQjwj7v0BRDOARIsAGh37iqiheTc56DBq7Jlz4YO5drNzmuK61TDsgWPAj9kuloGAo3w9VCKHrwaAi1QEALw_wcB. Accessed 10 Apr 2020
5. Morgner, C.: Die Evolution der Kunstmesse: the evolution of the art fair. Hist. Soc. Res./Historische Sozialforschung **39**(3), 318–336 (2014). https://doi.org/10.12759/HSR.39.2014.3.318-336
6. Latour, B.: Reassembling the Social: An Introduction to Actor-Network-Theory. Oxford University Press, Oxford (2007)
7. Cressman, D.: A brief overview of actor-network theory: punctualization, heterogeneous engineering & translation (2009)
8. Law, J.: Notes on the theory of the actor-network: ordering, strategy, and heterogeneity. Syst. Pract. **5**, 379–393 (1992). https://doi.org/10.1007/BF01059830
9. Callon, M.: Some elements of a sociology of translation: domestication of the scallops and the fishermen of St Brieuc Bay. Sociol. Rev. **32**, 196–233 (1984). https://doi.org/10.1111/j.1467-954X.1984.tb00113.x
10. Costa, C., Costa, C., Cunha, P.: The social dimension of business models: an actor-network theory perspective, 12
11. Tomlinson, J.: Cultural globalization reconsidered
12. Mallett, W.: Personal ads (2014). https://thenewinquiry.com/personal-ads/. Accessed 09 Apr 2020

Creating a Physical Bridge Between Management and Leadership as a Strategy to Improve Organization Performance Analysis

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Abstract. Managers are defined by their roles, responsibilities and characteristics aligned with the business goals and objective. In this, regard, the performance of the Organization, largely depend on the quality of management and leadership activities. In many cases, lack of managerial experience, incompetency, lack of leadership skills and inappropriate work experience are the major contributory factor to organizational and business failures. From studies, a major challenge within organizations is associated with restricted channels for innovation in decision-making and process optimization for managers. High emphasis on following the standardized processes, and procedures is another identified challenge. The gap between management and leadership strategies is often phenomenal. Most of the managers use the management functions of controlling, organizing, planning and directing for the applications of principles in connecting resources effectively and achieving the organizational goal without using their own personal strategies. Managers' are generally trained to follow the policies, processes and procedures handed by their seniors whereas; leaders are there to create solutions to problems encountered in the organization on continuous basis. It is important for managers to equip themselves with both leadership and management skills, in order to be multi-facetted on problem solving without following the standardized processes and procedures. The controlling, planning, organizing and directing role of managers will be highly effective when it is merged with the leadership skills and roles in achieving objectives of that policy. It requires the art of leadership skills to motivate employees towards achieving the common goal set by the organization. Under the inadequate management systems, the members of the organization would pursue their own daily agenda which results in resource and time misuse, causing various failure loops in an organization. The research reviews methods applied in different instances and it communicates the inferences identified based on obvious patterns and correlations that have effectively worked for organizations burdened with similar challenges.

Keywords: Management · Leadership · Performance analysis · Organization · Planning · Problem solving · Material · Management role

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1 Introduction

Management is the process followed by the appointed heads in undertaking the business goals and objectives by overseeing human, financial, physical and information resources [1]. Since humans is a social being, they arrange themselves in groups to achieve their social goals that may be relevant or irrelevant to that of their managers. It is very important to create the physical bridge between management and leadership strategies in creating Self-Management Work Team (SMWT) that is more productive and goal driven [2, 3]. With the adaptation of leadership role, managers will be capable of creating the effective SMWT that will enhance the profitability of their businesses or organisation.

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1.1 Leadership and Business Failure

From the studies, organizational failure is largely linked to structural lapses associated with the management as presented in Table 1.

Table 1. Organization failure metrix

Percentage of business failure	Identified causes of business failure	Explanation
40%	Managerial incompetence	Inability to run the business in terms of physical, intellectual and more
30%	Lack of leadership	Inability to think strategically and bring about change in the organization
20%	Lack of managerial experience	Little experience managing employees
10%	No industry experience	Little to none, experience in the product or service before venturing into the business

2 Background

Management is a systematic study that incorporates many disciplines and is an applied activity, regardless of the field of endeavor [4]. Many different managers perform almost

similar function to a lesser or greater extent. In this regard, for the appointed managers to operates effective and comply with management strategies, the management processes need to be adhered to. This management process is described as "a systematic and rational process that directs all the efforts within an organisation that support the process of converting inputs into outputs and influences the organisation in order to produce valuable outcomes [5]. Traditionally, the management are subjected to perform the following functions in the management processes: organising, leading, planning and controlling the all factors of productions and resources [6]. The management processes is affected by both internal and external environment that requires multiple strategies to control them effectively. The success of the managers is measured by the outputs/outcomes [7]. Figure 1 below shows the management process and factors associated with them.

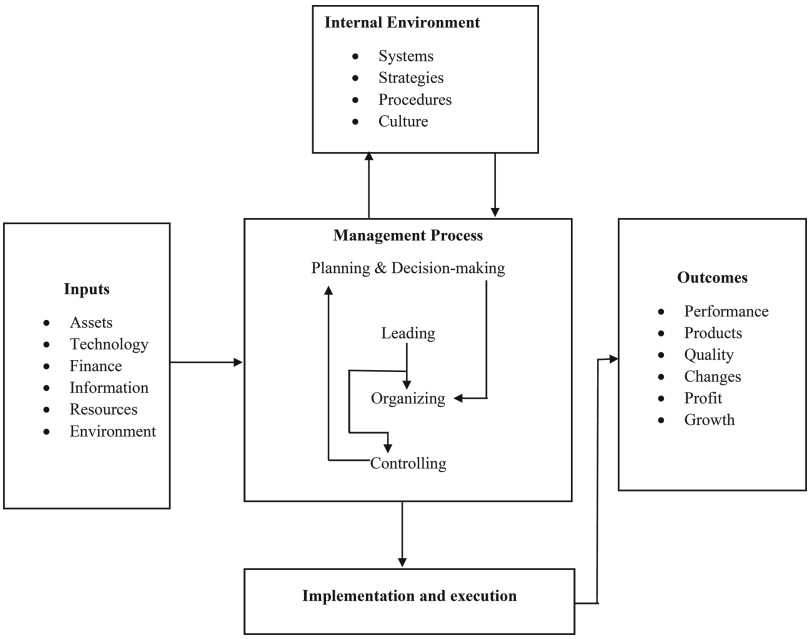

Fig. 1. Management process [2]

2.1 The Role of Management

It is the responsibility of every manager to fulfil the specific role, irrespective of the managerial level or function being handled [8]. Table 2 below shows the role of Managers.

Table 2. The role of managers [9]

Interpersonal roles	Decision roles	Information roles
Leadership roles	Entrepreneur	Disseminator
Liaisor	Resource allocator	Monitor
Figurehead	Agitation mitigator/negotiator	Spokesperson

3 Management and Leadership

In order to transform the manager to have both management and leadership skills concurrently, it is important for them to understand the difference between the two roles. Table 3 below shows some of the difference between the managers and leaders.

Table 3. Distinctive characteristics: leader and manager [10, 11]

Leaders	Managers
Set vision & direction	Follows the vision & directions
Originate and drive changes	Embed change (puts systems & structures)
Originate new ideas	Implements ideas
Identify opportunities	Work on given opportunities
Look for solutions	Implement solution given by seniors
Trusting relationship with followers	Put high value on productivity
Start new endeavors	Control new endeavors

Leadership is the ability to inspire people, a group, a team or an organisation to work together towards achieving worthwhile goal" [11]. It includes factors such as influencing, motivating and directing teams or individuals in such a way that, they pursue the organisational goals and objectives willingly [12]. It is important for the managers to have leadership element that set activities in motion and keeps the activities moving until the goal is accomplished. The management has to understand the most important components of leadership role of the management system. Leadership is management strategy that influence people to carryout activities willingly, without the continuous directives of their bosses [13]. For the manager to become a good leader, need to communicate their vision, plans, problem and expectations to the followers and listen to the ambitions and aspiration of followers [14]. Managers conveys the authority allocated to them to enforce, order and direct the activities to their subordinates and leaders get results without the use of any force [1–15]. Figure 2 shows components of the leadership task of management.

In order to improve the leadership skills of the managers, it is important to consider the factors influencing effective leadership (Fig. 3).

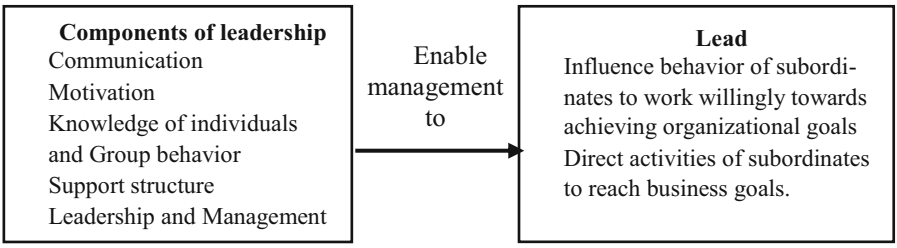

Fig. 2. Components of the leadership task of management

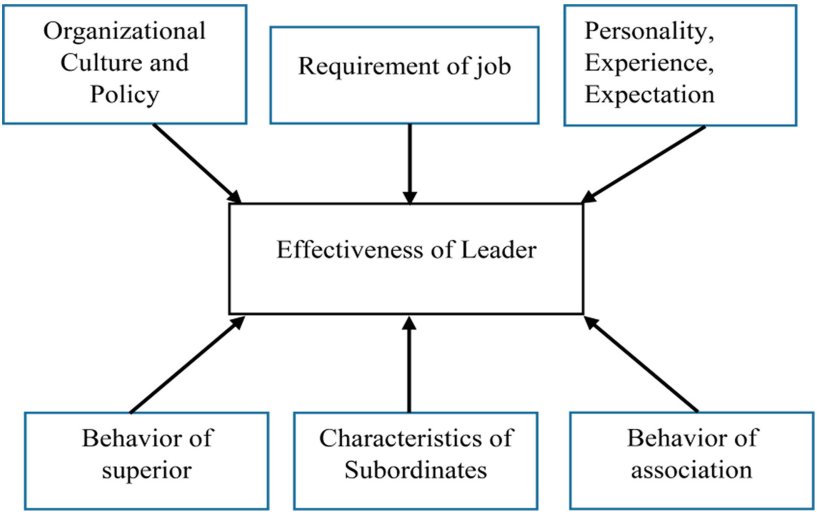

Fig. 3. Shows factors influencing leadership.

The practice of leadership role by the organizational management or businesses will create effective self-managing work teams (SMWT) [16]. SMWT is the most advanced form of labour empowerment that lead to higher productivity of workers. The team have high employee involvement, high-performance system, a partnership, semi-autonomous work team and self-driven [16, 17]. In the SMWT, employees are responsible for managing themselves and less directives from their seniors. The team members handle given tasks, assignments, plans and schedule work, make production and/or service-related decisions and take action on problem [18]. The Table 4 below shows the difference between SMWT and Traditional organisation managed without leadership.

Table 4. SMWT vs traditional organization managed by none-leader [1, 2]

Self-managing work team	Traditional organisation managed without leadership
Customer/employees driven	Management driven
Values and principles based	Policy and procedure
Employees self-controlled	Management controlled
High workers commitment	High management commitment
Whole business focus	Departmental/individual focus
Goal sharing	individual/segregated goad
Multi-skilled workers	Departmental specialisation
Wide information sharing	Individual information
self-controlled	Management controlled
Few levels of management	Many management levels

4 Conclusion

Management focus on processes and procedures of fulfilling the organisational goals and objectives. It is important for the managers to equip themselves with leadership skills that will allow them in directing all resources of the organisation towards achieving organisational goals. The effective leadership strategy build Self-management Work Team (SMWT) that will increase productivity by maximizing workforce effectively. The managers need to emphasis the leadership role in their day-to-day activities. Leadership is to get employees to believe in the vision set by the seniors on achieving the organisational goal. The management in the organisation must emphasis leadership role in administering daily activities carried by employees.

References

1. Stokes, D., Wilson, N., Wilson, N.: Small Business Management and Entrepreneurship. Cengage Learning EMEA, Andover (2010)
2. Nel, W.: Management for Engineers. Technologists and Scientists. Juta and Company Ltd., Cape Town (2007)
3. Cooney, R.: Empowered self-management and the design of work teams. Pers. Rev. **33**(6), 677–692 (2004)
4. Nienaber, H.: Conceptualisation of management and leadership. Manag. Decis. **48**(5), 661–675 (2010)
5. Kraines, G.A.: Accountability Leadership: How to Strengthen Productivity Through Sound Managerial Leadership. Career Press (2001)
6. DeCarlo, D.: Extreme Project Management: Using Leadership, Principles, and Tools to Deliver Value in the Face of Volatility. Wiley, San Francisco (2010)
7. Bush, T.: From management to leadership: semantic or meaningful change? Educ. Manag. Adm. Leadersh. **36**(2), 271–288 (2008)
8. McCartney, W.W., Campbell, C.R.: Leadership, management, and derailment. Leadersh. Organ. Dev. J. **27**(3), 190–202 (2006)

9. Lim, E., Boger, E.P.: Management requires leadership. Consortium J. Hospitality Tour. **9**(1), 59–66 (2005)
10. Mcgowan, P., Miller, J.: Management vs. leadership. Sch. Adm. **58**(10), 32–34 (2001)
11. Mujtaba, B.G.: Managerial Skills and Practices for Global Leadership. ILEAD Academy, Davie (2013)
12. Connors, T.D. (ed.): The Volunteer Management Handbook: Leadership Strategies for Success, vol. 235. Wiley, Hoboken (2011)
13. Yielder, J., Codling, A.: Management and leadership in the contemporary university. J. High. Educ. Policy Manag. **26**(3), 315–328 (2004)
14. Uhl-Bien, M., Graen, G.B.: Self-management and team-making in cross-functional work teams: discovering the keys to becoming an integrated team (1992)
15. Amanchukwu, R.N., Stanley, G.J., Ololube, N.P.: A review of leadership theories, principles and styles and their relevance to educational management. Management **5**(1), 6–14 (2015)
16. Goetsch, D.L., Davis, S.B.: Quality Management for Organizational Excellence. Pearson, Upper Saddle River (2014)
17. McKimm, J., Phillips, K. (eds.): Leadership and Management in Integrated Services. Learning Matters, Exeter (2009)
18. Nienaber, H., Roodt, G.: Management and leadership: buccaneering or science? Eur. Bus. Rev. **20**(1), 36–50 (2008)

Development Status and Marketing Strategy of Smart Speakers

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Abstract. 2017 is the year of the explosion of smart speakers, because of the gradual maturity of voice interaction technology and the development of artificial intelligence technology. The production of smart speakers is constantly increasing, and the function of smart speakers is constantly improved and perfected. Also, there are more and more application scenarios of smart speakers. It is seen as a key entrance point for the smart home of the future. At the same time, there are various marketing strategies for smart speakers in the era of intelligent interconnection, and the traditional marketing theory combines with the current new marketing strategy. Based on this, this article analyzes the development status and marketing strategy of smart speakers and discusses its existing problems and the development of marketing strategies.

Keywords: Smart speaker · Marketing strategy · Marketing

1 Introduction

Bank of America Merrill Lynch, one of the world's largest financial institutions, mentioned in the Ten Investment Trends in the Next Decade that by 2030, there will be 500 billion smart devices in the world. The device generates 5,000 interactions. In the era of the Internet of Everything, smart speakers, as a vital carrier between smart terminals, people and cloud services, at the forefront of the development of the artificial intelligence industry and will undoubtedly play a role in the global intelligent process.

Smart speakers started in 2014 and broke out in 2017, with more and more product differentiation emerging and competition among industry giants becoming more intense. At the same time, the Internet has evolved from the era of the pc Internet to the era of mobile Internet, and now to the smart in the connected era, the marketing model is constantly changing. The marketing model in the traditional industrial era is direct and single, and it is mainly based on the straight-line process of "manufacturer-agent-retailer-customer". In the era of the PC Internet, brands began to rise Overwhelmingly, channels, products, packages, and advertisements are all indispensable. Each independent marketing model gradually shifts from decentralized to integrated. In the era of the mobile Internet, the business environment has changed dramatically, and the main

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consumer groups have turned to the new generation of Internet users. "User-centered" is the key word of this era. In today's intelligent and interconnected era, rich cross-border interactions between scenes and transactions, as well as full-time, all-channel, and fully-integrated marketing models have gradually become mainstream. On-line and off-line penetration has become a trend.

2 Development Status of Smart Speakers

2.1 Smart Speakers

Amazon released the first smart speaker Echo in 2014 in human history (Fig. 1). This product, which uses voice interaction as the core, completely subverts people's perception of traditional speakers. After two years of silence. In 2017, smart speaker products had a big explosion ushered and attracted many global technology giants to enter the market, and the market was soaring. The goal of all parties is to seize the flow of smart speakers and create a new smart home ecosystem [1].

Fig. 1. AmazonEcho smart speaker

Compared with traditional speakers, smart speakers are intelligent products that cover Internet services, information content services, and voice interaction functions. They have mobile connection functions such as Bluetooth, Wi-Fi, and mobile networks. They can provide radio programs, music movies, and audio books. Other audio-visual content services also include Internet services such as information query, smart reminders, and online shopping. In addition, it can also connect to smart homes to achieve scene-based intelligent control. Figure 2 shows the smart speaker product lines of several giant companies such as Amazon, Google, Apple, Alibaba, Xiaomi, and Baidu.

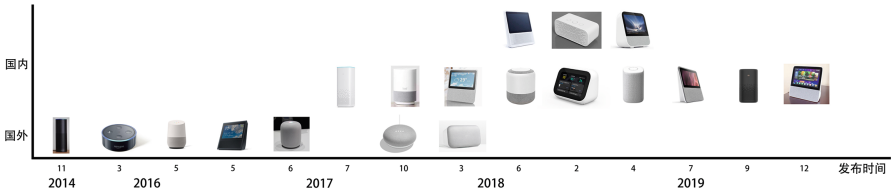

Fig. 2. Smart speaker product lines of several giant companies

2.2 Rapid Expansion

According to omway cloud network omni-channel data, in the first half of 2019, China's smart speaker market sales exceeded 15 million units, an increase of 233% year-on-year, and sales exceeded 3 billion yuan, an increase of 149% year-on-year. Close to the whole of 2018.

According to the global smart speaker market data report, the total global smart speaker shipments in the fourth quarter of 2019 reached 55.7 million units, an increase of 44.7% from last year's 38.5 million units. Among them, domestic brands such as Baidu and Alibaba in the global smart speaker The numbers in the sales charts are dazzling.

With the popularization and development of smart terminal equipment, the smart speaker market has become a "competitive place" for Internet giants. In 2018, the United States also ranked first in the global smart speaker market. However, in 2019, China's smart speakers Vendors have captured a third of the global market share.

Table 1 shows the global smart speaker shipments in the fourth quarter of 2019.

Table 1. Global q4 smart speaker shipments in 2019

Company	2019Q4 shipments/million	2019Q4 market share	2018Q4 shipments/million	2018Q4 market share	Year-on-year increase
Amazon	15.8	28.30%	13.7	35.50%	16.00%
Google	13.9	24.90%	11.5	30.00%	20.00%
Baidu	5.9	10.60%	2.2	5.70%	171.00%
Alibaba	5.5	9.80%	2.8	7.30%	94.00%
Xiaomi	4.7	8.40%	1.8	4.50%	167.00%
Apple	2.6	4.70%	1.6	4.10%	65.00%
Other	7.4	13.30%	5	13.00%	49.00%
Total	55.7	100.00%	38.5	100.00%	44.70%

2.3 Continuous Improvement

As application scenarios continue to be enriched, the product functions of smart speakers have shifted from initial voice interaction assistants, audio resource playback, and smart home control to life o2o services. The emergence of smart speakers with screens has further expanded their functions to film and television resources. Playback, video calling and monitoring, cloud albums, mini games, etc.

1. Voice interactive assistant
   Voice interaction technology is at the core of smart speakers. From the most basic mathematical calculations and voice songs, to relatively complex voiceprint shopping and take-out orders, users can control smart speakers through voice. Currently,

for voice interaction The research on the technical side has deepened, and the understanding and feedback of natural semantics have become more accurate. Even some domestic manufacturers also support dialects in some regions.

2. Audiovisual resource playback
   The speaker as a playback carrier supports each other with content. With the emergence of smart speakers with screens, the content of smart speakers can already cover all kinds of audio-visual resources. Take Tmall Genie CCL as an example, its audio content is very rich, in addition to its own As the support of the company's shrimp music, it also cooperates with Weibo, Himalayan FM, Dragonfly FM, China Radio and various radio stations and daily newspapers, which can basically meet the all-round needs of users for audio content. In addition, it can be regarded as a reduced version of "Home Theater", in addition to cooperating with video sites such as Mango TV, Youku, and Bilibili, it also cooperates with children's application companies such as baby bus, VIPkid, 51Talk, etc. to meet the different needs of different age groups.
3. Smart home control
   Smart speakers are considered as the terminal of future smart homes, which is one of the reasons that major technology giants pay attention to them. At present, smart speakers can already control some basic smart home equipment, such as smart light bulbs, smart sockets, smart curtains, and smart air conditioners. Smart appliances such as smart washing machines and smart rice cookers.
4. Life o2o service
   Life services is one of the important functions of smart speakers. Users can query related information such as road conditions, restaurants, logistics, ticketing, and hotels by binding third-party applications such as Alipay, rookie wrappers, Didi, and are you hungry? You can even order takeaway or order online through your voice, and Voiceprint Shopping has brought a brand-new experience to users.
5. Other application functions
   The smart speaker with screen is similar to the reduced version of the tablet computer. Users can use the smart speaker with screen to make video calls, as cloud albums, for game entertainment, etc., eliminating the need for users to purchase electronic albums, electronic monitors and other equipment, and the price is compared. Tablets have more advantages.

2.4 Diverse Design Style

The overall product design of the smart speaker is very simple. The product form has evolved from the initially released cylinder to a smaller and thinner form. The color of the product has also evolved from black and white and gray to a colorful color scheme. Take Tmall Elf as an example. The cat spirit sugar candy r incorporates pop colors into the product, giving users a relaxed and youthful visual experience. And Tmall Elf cooperates with Starbucks, mm beans, Pepsi, Pikachu and Doraemon and other IP companies to cooperate with each other. The integration of different trendy elements and ai products has broken the uniform coldness in the market. As shown in Fig. 2 and 3, the Tmall Genie joint products are designed. And Tmall Genie and related downstream industries have designed different colors and shapes. Silicone protective cover, which adds to the fun of the product. Figure 3 shows the Tmall Elf protective cover.

Fig. 3. Tmall Elf co-branded products and protector

2.5 Limitations

Chinese smart speaker market is expanding rapidly, the market demand is growing rapidly, and product blowouts are being launched. Ordinary users want to try something new, and technology giants are racing. The Chinese smart speaker market has not experienced long foreign market training cycles. Occupy more smart home traffic entrances, not profit-oriented, and repeatedly lower product pricing. Behind the low price, there are also hidden shortcomings and defects of its own products and industry chain. The limitations of smart speakers are mainly reflected in three points.

The first is the limitation of voice interaction technology. Many users experience poor performance when using smart speaker products. The product faces problems such as low wake-up rate, slow response speed, and weak voice interaction recognition rate, which involves far-field recognition capabilities, continuous Dialogue functions, semantic comprehension capabilities, and sound quality levels. Therefore, as the core part of smart speakers, there is still much room for improvement in semantic understanding and feedback.

The second is the limitation of smart speaker application scenarios. Smart speakers are considered as the terminal of future smart homes, but smart home equipment has not yet become widespread, and the smart home industry has not yet formed a unified industry standard, which has led to a smart speaker that can be connected to Household appliances are limited, which will affect the user experience. Moreover, if the smart speaker can take care of a more diverse group of people with its existing features, its transmission power will be further enhanced [2]. Therefore, the continued expansion of application scenarios is still a major problem for smart speakers.

The third is the limitation of the ecological integrity of the content and services contained in smart speakers. Different smart speaker brands are difficult to be comprehensive when integrating content and services and will be restricted by some brands and copyrights. Therefore, smart speakers also need Integrate more services and applications.

In summary, smart speakers have not yet penetrated into more life scenes, and the degree of "smartness" needs to be strengthened. So how can smart speakers tear off the "toy" label and become the best form of smart home terminals in the future? Waiting for optimization and improvement of smart speaker products and industry.

3 Application of 4Ps Marketing Theory in Smart Speaker Marketing Strategy

3.1 4Ps Marketing Theory

The 4Ps marketing theory is attributed to the combination of four basic strategies: Product, Price, Place, and Promotion.

The product strategy mainly includes the combination and use of product-related categories, functions, specifications, styles, quality, packaging, features, trademarks, brands, and various services. The functional requirements of products are the most important.

The price strategy mainly includes price-related pricing, discounts, allowances, instalments, credit reporting, and various pricing methods and pricing techniques. Products will develop different pricing strategies according to different market positioning. When pricing products, they must also pay attention to the brand. Gold content.

Channel strategies mainly include the combination and application of distribution-related channel coverage, commodity circulation links, middlemen, outlet settings, and storage and transportation channels, so as to form a sales network and establish connections with consumers.

The promotion strategy mainly includes the combination and application of promotion-related brand promotion, advertising, personnel sales, business promotion, and public relations.

The traditional "4ps" marketing theory is still of great significance in the marketing of smart speaker products.

3.2 Application of 4Ps Marketing Theory

As shown in Fig. 4, it is the product line of Tmall Genie.

Firstly, from the perspective of product strategy, Tmall Genie's product line is divided into three categories. The first category is characterized by a cylindrical box that surrounds the metal mesh, and the second category is a square box with a single metal mesh. The third category is smart speakers with screens. In addition to the differences in appearance, the functions of the three categories of products are also more perfect.

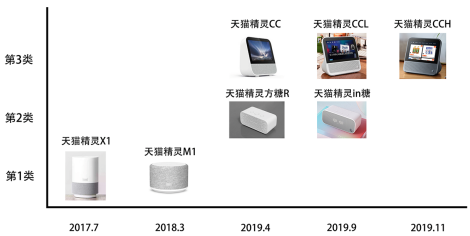

Fig. 4. Tmall Genie Product Line

Secondly, from the perspective of price strategy, as shown in Table 2, the prices of 7 products of Tmall Elf. From the pricing, we can see that the price of cube r is the lowest, the price of smart speakers with screen is higher, and 7 products Basically, there are different degrees of discounts. This is the price subsidy battle for manufacturers to seize offline smart home traffic. The target users of smart speakers are mostly post-80s and post-90s. They are more sensitive to price numbers and low-price promotions. Attracting consumer attention, from the above shipments of Tmall Elves, it can be seen that the effect of price subsidies is significant.

Table 2. Tmall Genie 7 product prices

Product line	Standard price/yuan	Promotional price/yuan	Discount
Tmall Elf x1	499	259	0.52
Tmall Elf m1	399	399	1.00
Tmall Elf Cubes r	199	89	0.45
Tmall Elf cc	549	499	0.91
Tmall Elf in Sugar	199	149	0.75
Lynx elf ccl	499	379	0.76
Tmall elf cch	999	599	0.60

Third, from the perspective of channel strategy, Tmall Elf Smart Speakers basically focuses on online channels, and through online promotion strategies, it attracts users and improves the conversion rate.

Finally, from the perspective of publicity strategies, taking Tmall Elves as an example, this article mainly explores its unique marketing strategies.

3.3 Marketing Strategy Status of Smart Speakers

Firstly, leverage marketing. Leverage marketing hides the purpose of sales in marketing activities, integrates product promotion into an environment that consumers are willing to accept, and enables consumers to understand and accept products in this environment. The specific performance is through the media Exposure attracts consumers' attention, makes second exposure through consumers' own communication power, and guides market consumption through easy entertainment. Generally speaking, the carriers of leverage marketing are relatively wide, which can be online pop, entertainment news, social events It can also be culture, festivals, etc. [3]. Tmall Elf took advantage of Shenzhen Satellite TV to launch the "trade-in" activity in 100 stores in 33 cities across the country on June 2, 2018, and borrowed it on June 5. In the World Environment Day, the topic of "10,000 pieces of used objects disposal opinions" was publicly launched through the official Shuangwei, and the used objects collected in offline activities were publicly processed, solicited netizens' brains, transformed user power, and diffused through the user's second exposure Brand influence. Finally, the official Tmall Elf teamed

up with Youku's "Chief Green Environmental Officer" program to encourage users to do their own transformation, and users have the opportunity to cooperate with the official contracted art masters to transform. Every time a household participates in an action, Tmall Elf officially donates to the Alxa See Foundation, combining users with charity, making this marketing campaign endless. From beginning to end, this marketing activity of Tmall Elf is closely centered on environmental protection, charity, etc. A hot topic that expands the brand's influence in a relaxed atmosphere and accessible activities.

Second, ip marketing. Driven by the information technology revolution and capital forces, ip has become the most popular high-frequency word and popular business model in the cultural industry. IP refers to the gathering of fan emotions through high-quality content and has symbolic value. Content products with economic value and brand value [4]. Tmall Genie cooperates with popular IPs such as Pikachu and Doraemon to limit the sale of co-branded smart speakers to limit the IP economy, triggering a fan boom and harvesting the fan economy.

Third, red envelope marketing. Red envelope marketing emerged as the Internet giants seized the mobile payment market and the e-commerce market, with strong social fission capabilities. Alipay's "pulling new" and Pinduoduo's "cut a knife" are extremely successful red envelopes Marketing case. Tmall Elf launched the "Red envelope alarm clock" function during Double Eleven. Users who have Tmall Elf can just say "Tmall Elf, I want a red envelope" to Tmall Elf and set the Tmall Elf red envelope alarm. It is open at regular intervals. Users only need to input voice to enter the red envelope, and red envelope marketing enters the era of voice interaction. In this red envelope marketing, the fun way to grab red envelopes through voice interaction has improved the user's social activity Degree, prompting users to accept voice interaction more.

4 Marketing Strategy Suggestions of Smart Speakers

4.1 Experience Marketing and Word of Mouth Marketing

Experience marketing is at the core of satisfying the spiritual needs of consumers. The use of online social tools, listening, viewing, and participation can effectively mobilize customers' thinking, actions, senses, and emotions, thereby helping brand companies expand their interaction channels [5]. In the current developed network environment, users can participate in the exposure, release, and sale of a product in the entire process. In the entire process, users can basically experience all product functions except tactile through audio and visual.

Word-of-mouth marketing is regarded by modern marketers as the most viral marketing model, and it is also the cheapest, most accurate, and most credible information dissemination tool in the world today [6]. Word-of-mouth supports an industry or a product that can maximize It attracts users and gains competitiveness. Unlike the spontaneous word-of-mouth communication that was spread by word of mouth in the past, the development of the Internet today has greatly expanded the speed, breadth and depth of word-of-mouth communication.

Smart speaker products are born in the context of the Internet. The industry should be prepared for users to experience the integrity of the product on the Internet. The release of a product and the market operation after the release should be carried out through social

media and platform traffic. Dissemination and maintenance. After users experience the real product, focus on discovering high-quality evaluation content, fermenting product reputation, identifying product opportunities, and doing market public relations.

4.2 Internet Celebrity Marketing and Short Video Marketing

Zhang Shilong, a well-known Chinese business psychologist and behind-the-scenes promoter of the influencer economy, analyzed the business logic of the influencer era: The traffic in the hands of internet celebrities can influence many downstream industries" [7]. Internet celebrities gradually accumulate popularity through social media and rely on fan groups for targeted marketing. It has the characteristics of popularization, affordable prices, and precise target groups. It has developed rapidly.

Short video marketing can be understood as a way for companies and brand owners to use social media such as short videos for social marketing [8]. The 4g era has made the short video industry rise, and its development speed and expansion scale have attracted many companies and Brand attention. Short video marketing relies on platform traffic to attract fans and output high-quality content for precise marketing, which coincides with influencer marketing. It can be said that influencers and short video platforms mutually achieve each other, and influencer marketing and short Video marketing complements each other.

Smart speakers are moderately priced, and different categories are targeted at different user groups. Generally speaking, the focus is on post-80s and post-90s. Take the short video platform "vibrato" as an example. 95% of its users are under 40 years old. The target audience of the speaker fits. The smart speaker industry can take advantage of the huge traffic of the short video platform and the influence of the influencer to output the characteristics and convenience of the product into high-quality short video content, so as to spread it to more users. With the help of user experience and word of mouth, secondary fermentation of social media is achieved to achieve marketing purposes. As shown in Fig. 5, the age percentage of Douyin users.

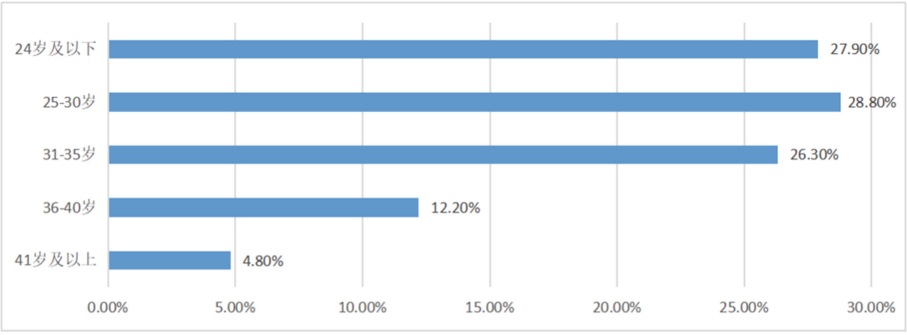

Fig. 5. Age proportion of people using Douyin

5 Conclusion

From the perspective of the smart speaker itself, although there is still a certain gap between the distance from a smart speaker and a real smart home terminal, it is undeniable that its presence will become stronger and stronger. The smart speaker frees users' hands in a certain degree and in certain scenarios and eyes, making the voice interaction mode a new interaction mode among people, people and things, and things and things. At the same time, the smart speaker also facilitates the elderly and children's control of household appliances to a certain extent, enriching the user's Daily experience. In general, the field of smart speakers is at the forefront of the development of the artificial intelligence industry, more functional innovations have yet to be tapped by the industry and users, and existing deficiencies will be gradually resolved as technology advances.

From the perspective of the marketing strategy of smart speakers, in addition to its own borrowing marketing, IP marketing, and red envelope marketing, it should also combine experience marketing, word-of-mouth marketing, online influencer marketing, and short video marketing. Facilitating the huge traffic of short video platforms, the stickiness of Internet celebrity fans, the advancement of user experience, and the advantages of user word-of-mouth communication on the Internet, seize the upcoming 5g era, and fully achieve the marketing purpose of smart speaker products.

References

1. Su, J., Lin, J., Hong, B., Gan, Y., Lu, W.: Analysis of the current status and future development trend of smart speaker technology and products. Guangdong Commun. Technol. (6), 167–173 (2018)
2. He, C.: Analysis of the development prospect of smart speakers in the era of "experience economy". Media Forum (15), 123–125 (2019)
3. Ren, Q.: Analysis of marketing strategies for e-commerce enterprises. Manag. Obs. (29), 15–16 (2019)
4. Chen, W.: Research on brand creative communication and marketing based on second-generation IP. J. Chongqing Three Gorges Univ. (6), 42–48 (2019)
5. Song, Y., Liu, J.: Effects and optimization of online experience marketing for retail brands. Bus. Econ. Res. (1), 53–55 (2018)
6. National Center for Biotechnology Information. http://www.ncbi.nlm.nih.gov
7. Yuan, Y.: Internet celebrity marketing analysis and future development trend. Econ. Res. Ref. (54), 28–29 (2017)
8. Ma, Y., Wu, Y.: Short video marketing in the era of mobile internet. China Stat. (12), 26–28 (2018)

Management and Leadership

The Governance of Inclusive Maritime Higher Education in the Philippines

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Abstract. Maritime activities, including sea transport, fishing, and marine tourism are closely tied to the lives of many Filipinos for the Philippines being archipelagic and consist of 7,100 islands. It is therefore natural for many Filipinos to pursue a maritime career by attending maritime education and training (MET) programs [1]. Filipinos used to be the leading supplier of seafarers in the global market, however in recent years, China, Russia and other seafarer-supplying countries are pushing up their ranks. A global estimate in the demand of seafarers is 92,000 in 2020 to 147, 500 in 2025 [2]. However, in order to build the maximum capacity of Filipino seafarers, the need to provide inclusive MET as well as the reduction of economic and geographical inequalities among the different regions. This paper compares selected MET institutions' access by numbers in different administrative regions and presents preliminary analysis on the influence of governance in terms of accessibility to MET.

Keywords: Maritime Education and Training (MET) · Governance · Inclusive maritime higher education · Seafarers · The Philippines

1 Introduction

Sea transport, fishing, marine tourism and other maritime activities have been part of the lives of many Filipinos. It can be traced on the archipelagic state of the Philippines with approximately 7,100 islands. Hence, there is a great tendency for the Filipinos to pursue a maritime career through the aid and service of different schools which offer a variety of maritime courses and programs [1]. As a result, the Philippines have around 402,000 Filipino seafarers that contributed to roughly 30% of the global maritime workforce [2].

In recent years, however, the capacity of the Philippines as a leading seafarer supply nation has been questioned. According to the Philippine Association of Maritime Institutions (PAMI), maritime higher education institutions (MHEIs) in the Philippines are always catching up and may not be at par with other countries. PAMI stated that along with the advancement of the country, the problem on compliance to international quality standards is still a pressing issue [3]. The Commission of Higher Education (CHED) and Maritime Industry Authority (MARINA) issued numerous circulars to institute MHEIs reforms which have led to a lot of difficulties in the academic and administrative operation. These reforms sometimes resulted into lawsuits; fortunately, the Philippine judicial

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system has found merits in the ongoing reforms that most of the cases have been resolved in favor the government [4]. Eventually, these reforms roll down to the student where the increase in curricular requirements resulted to increase in tuition fees and additional training expenses. This reforms are mostly precipitated by the European Maritime Safety Administration (EMSA) results of evaluation inspection regarding aspects of MET that MARINA needs to comply since 2006 [5]. Good governance measures in the administration of maritime education and training programs is included in MARINA major action as well as collaboration with CHED specifically on the review of the existing policies, standards and guidelines governing the Bachelor of Science in Marine Transportation (BSMT) and Bachelor of Science in Marine Engineering (BSMarE) [6]. This precipitates the issuance of numerous memorandum circulars and orders in short span of time from CHED and MARINA since 2013.

There are seventy (70) recognized MHEIs in the Philippines; sixty-five (65) are private institution where students paid their matriculation, training fees, sundries and other fees. This is aggravated by the geographical situation of the Philippines being archipelagic where those students from the regions or islands without any MHEI need to go to Metro Manila or other big cities for their studies. The transport situation in these areas gives so much strain in the quality of life of the populace, including labor force, students and other commuters not just on public health but as well as in monetary terms [7]. This resulted into the need for most MHEIs students from other regions or even cities to rent their own lodging spaces near the institution that leads to additional educational expenses for them.

Indeed, the importance of inclusive education is internationally recognized through the United Nations Sustainable Development Goal (UNSDG) 4 (Ensure inclusive and equitable quality education and promote lifelong learning opportunities for all), as well as the campaigns by the International Bureau of Education (IBE) UNESCO. However, in the context of maritime higher education in the Philippines, the literature often focuses on quality education but not much on inclusive education. This paper therefore presents a baseline study on the access to maritime higher education by regions in the Philippines and examines regional gaps from the perspective of maritime higher education governance in the Philippines.

2 Maritime Labor and the Economy of the Philippines

From 2003 to 2010, the Philippines was the biggest supplier of seafarers comprising 12.39% of officers and 21.86% of ratings worldwide [8]. In 2015, the Baltic and International Maritime Council (BIMCO) and the International Chamber of Shipping (ICS) summarized in their Manpower Report that China, the Philippines and Russia were on an equal rank as the leading supply countries [9]. However, in terms of ratings, Philippines remained to be the biggest supplier of ratings worldwide followed by China and Indonesia. There is an escalating demand for seafarers which will likely continue and is expected to rise to 92,000 in 2020 and about 147, 500 in 2025 [2]. Thus, there seems to be a promising future for anyone who decides to become a seafarer.

Over the years, the remittances of Filipino seafarers have significantly contributed to the development of their country of origin. In 2011seafarers remitted the total of US$ 4.4

billion representing about 22% of the total remittances of US$ 19.4 billion from Overseas Filipino Workers [10]. In a study made by the Commission on Filipinos Overseas (CFO) in 2016, Filipino seafarers infused about US $5.575 billion to the country's economy through their remittances. Total remittances from the seafarers alone accounted for 9.8% of Gross Domestic Product and 8.3% of Gross National Income [11]. Bangko Sentral Filipinas projected that the Filipino seafarers' remittances could exceed US$6 billion by 2018 [12]. The Philippines counts on the maritime industry as a vital component in attaining inclusive growth and reducing socio-economic instability.

The country has a huge human capital matching the general requirements of the maritime labor market which still holds a great potential due to the growing number of vacant officer positions on international vessels [13]. The role of the Philippines' Government in ensuring conformity with the requirements of the International Convention on Standards of Training, Certification and Watchkeeping (STCW), 1978 and its Amendments in turn makes the Filipino seafarers more responsive to the needs of the industry thereby maintaining their global competitiveness [10]. The Philippines is expected to flourish further if the regulating government agencies will continue to strengthen its on-going procedures of ensuring the compliance of schools in the prescribed standards [11]. In additional, the need to provide an inclusive MET as well as tap the maximum potential of the different regions is necessary to maximize the full capacity of Filipino seafarers.

3 Maritime Higher Education in the Philippines

There are academic institutions and training centers called Maritime Education and Training Institutions (METIs) that provide education and training to those who want to pursue a seafaring career in the maritime industry. The METIs are governed by three (3) government organizations namely, the Maritime Industry Authority (MARINA), Commission on Higher Education (CHED), and Technical Education and Skills Development Authority (TESDA) [9]. By the virtue of the MARINA Act [17], governance of MHEIs, MTIs and technical or vocational institutions shall be overseen by MARINA in reference to compliance with the requirement with the STCW convention as amended.

Lately, by the virtue of the Executive Order No. 63 further strengthening the authority of the Maritime Industry Authority as the single maritime administration for the purpose of implementing the STCW convention as amended [18]. CHED and MARINA now co-releases the Joint CHED-MARINA Memorandum Circular (JCMMC) that covers the guidelines on joint monitoring of maritime education programs to strengthen the implementation of STCW Convention and its amendments requirements. In addition, the EO # 63 directed all the government agencies to cooperate with Marina in the implementation of STCW regulation, this can be clearly construed that any regulatory action leading to improvements of maritime education can be easily implemented with less any operational or regulatory obstacles.

3.1 Inclusive Education: The Case of Filipino Seafarers

Inclusive education is about ensuring access to quality education for all students by effectively meeting their diverse needs by effectively meeting their diverse needs in a

way that the students can participate in the education program in a responsive, accepting, respectful and supportive manner [20]. In the Philippines, the problem with inclusive education mostly focused on two things: equipment and teacher's capability, this could be one of the reason why many teachers in the Philippines doubt their capability to teach in an inclusive school [21]. In maritime higher education, inclusive education is written as part of CHED-MARINA statement of policies by quoting the Philippine constitution that it is a right of every citizen to quality education and by recognizing that promoting and protecting the quality maritime education is a matter of national interest and an international obligation being a party and signatory to STCW convention as amended [19].

3.2 The Quality Tertiary Education Act of 2017 and UNSDGs

The UNSDG Goal 4 evolves on the principle that education is a fundamental human right and an enabling right. Each country must ensure universal access to inclusive and equitable quality education and learning, for all its citizens. Education implies an inclusive process of public policy formulation and implementation. Every citizen has all have important roles in realizing the right to quality education and the role of the state is essential in setting and regulating standards and norms [22].

In response, The Philippine congress passes the Republic Act 10931 also known as the Universal Access to Quality Tertiary Education Act of 2017 which declares "that higher education is an alienable right of every of every Filipinos and it is the policy of the state to protect and promote the rights of all students to quality education at all levels and the state must make steps to make such education accessible to all" [23], Sect. 2 declares that:

> …"*the state hereby recognized the public and private higher education institutions and technical vocational institutions in the educational systems and the invaluable contributions that the private tertiary schools have make and will make to education for this intent the state shall:*
>
> *a) Provide adequate funding and such other mechanisms to increase the participation rate among all socio-economic classes in education…*

Subsequently, guidance was issued by CHED in December 2016 for the implementation of free tuition for SUCs. CHED further states that the law will incrementally improve enrollment rates and will help free up financial resources for other expenses and needs of students. In broader perspective this will eventually increase the available income of families [24].

4 Methods

The article is based on the proposed study and pilot testing that was conducted from March to December 2019. It adopted a quantitative approach to determine if needed there was a gap in the inclusive maritime higher education in the Philippines. For the enrollment figures and the number of MHEIs within the administrative regions of the

Philippines, a request was made for the respective CHED regional offices. Eight regional offices representing 53 MHEIs respond to the request while the CHED-Office of Products and Standards Development (CHED-OPSD) responded with the complete list of all the MHEIs enrollees and graduates for the school years 2016-2018. These two sets of data give the freedom to compare the records received from CHED regional offices and central office. Secondary data was also obtained from CHED-Knowledge Management Division that provides statistics informatics achieved statistics on higher education data [25]. The data obtained were the regional enrollment, tuition fees, salary rates and food threshold to determine if there was indeed a gap in the inclusive access to maritime higher education programs in both private and public MHEI. Data on the employment rates, food threshold and tuition fees was obtained from NWPC, PSA and individually posted MHEI's websites.

5 Findings

To summarize the findings, the enrollment figures and the number of MHEIs within the administrative regions of the Philippines are shown in Table 1. The member of MHEIs and enrollment on different region shows that only four (4) regions namely Regions III, VII, VIII and IX, has public MHEIs constituting 6,032 students or just 7.5% enjoyed the privilege of free education as per Republic Act no. 10931.

The table also presented those two (2) regions, Cordillera Administrative Region (CAR) and Autonomous Region in Muslim Mindanao (ARMM) the two regions by the Philippine Constitution due to majority of ethnic population and distinct historical, cultural heritage, and economic and social structures, there are no MHEI in these regions. It is also worthy to note that the minimum monthly earners cannot afford to enroll their children into the private MHEIs because of the need for tuition fee and other basic subsistence needs. Data on the employment rates, food threshold and tuition fees were obtained from NWPC, PSA and individual MHEIs posted websites. Data were posted on the table, the sums and average were analyzed and compared to determine if each create a gap in inclusive maritime higher education. Also, in reference to the data presented, it was evident that there is a congestion of students in some regions. With this, the faculty to student ratio and the laboratory to enrollment ratio were stretch to the limit, thereby giving challenges to the MHEI administration and governing bodies to properly evaluate, monitor and implement policies and guidelines for the MHEIs.

The most significant finding emerged in this study is that some regions (CAR and ARMM) constituting millions of population have still a gap in inclusive maritime higher education, although it considers as an aspiration of many younger generations. Even there are other higher education institutions in their region, none offers maritime education. Therefore, the students in this place need to enroll in other regions in order to study maritime higher education, because of their financial burden on their studies is increased. Also, only four (4) regions have public MHEIs where students can enjoy the free tuition and the rest have to enroll on private institutions and take the burden of paying tuition fees. It was also found out that the gap between the family food threshold and the minimum salary scale is low that leaves maritime education beyond the capacity of minimum earners family.

Table 1. Philippine MHEI Enrollment Rates, Tuition, Salary Rates and Food Thresholds CY 2018 (Source: Authors' analysis based on the data from Philippine Statistics Authority (PSA), National Wages Productivity Commission (NWPC), Commission on Higher Education – Regional and Central Offices)

Region	Population	MHEI		Enrollment		Average tuition fee per month	Monthly minimum wage rates	Food threshold
		Public	Private	Public	Private			
I	5,026,128	0	6	0	7304	2720	8,500	9,015
II	3,451,410	0	2	0	1708	2720	10,500	8,480
III	11,218,177	1	6	1581	4112	3450	10,500	9,071
IV-A	14,414,774	0	7	0	5941	5400	10,000	9,565
IV-B	2,963,360	0	2	0	904	5400	8,000	7,954
V	5,796,989	0	5	0	3347	4000	7,750	8,319
VI	4,477,247	0	8	0	12330	3700	9,875	8,304
VII	6,041,903	1	6	2094	16177	3425	10,100	8,828
VIII	4,440,150	1	0	1054	0	640	7,875	8,532
IX	3,629,783	2	1	1303	963	600	7,900	8,700
X	4,689,302	0	3	0	2113	3700	9,125	8,550
XI	4,893,318	0	4	0	3940	3000	9,900	8,877
XII	4,545,276	0	1	0	1623	3000	7,775	8,380
XIII	2,596,709	0	2	0	744	3400	8,000	8,623
NCR	12,877,253	0	12	0	13550	5850	13,425	9,848
CAR	1,722,006	0	0	0	0	0	8,750	8,616
ARMM	3,781,387	0	0	0	0	0	8,125	9,565
Philippines				Total	**80,788**	Ave **3,643**	Ave **9,182**	Ave **8,804**

6 Conclusion and Recommendation

The Philippine administration is exerting efforts to ensure that inclusive maritime higher education is within the reach of the majority of its population. This is strengthened by the passing of the Universal Access to Quality Education Act and the consonance with the UNSDG, in particular Goal 4 where the Philippines as a member State must endeavor to conform. More importantly, the right to quality education is where policy of Joint CHED-MARINA Memorandum Circular is underpinned.

At present, however, not all regions are equal in terms of access to public maritime education institutions or even a maritime institution in their region which brings gap to inclusive maritime higher education. Also, if MHEI is present the matriculation fee is beyond the reach of families within the poverty line. To arrest this gap, a regional public MHEIs and/or widely disseminated subsidy not only on tuition fee but as well

as miscellaneous/living expenses from must be considered to bridge the gap and assist those without access or with harder access to maritime higher education.

Likewise, an assistance to the MHEIs in regions where concentration of students must be considered not only in terms of supply and logistics but also in academic research and development. Also recommended is the strengthening of regional maritime higher education governing bodies that shall focus closely on the needs of MHEIs and students on local levels. Strengthened regional governance in turn may encourage existing college/universities to offer maritime higher education programs through academic, technical and other logistical assistance.

References

1. Baylon, A., Santos, E.: The challenges in Philippine maritime education and training. Int. J. Innov. Interdisc. Res. **1**, 349–356 (2011)
2. BIMCO/ICS: Manpower Report; Global Supply and Demand for Seafarers in 2015. http://www.ics-shipping.org/docs/default-source/resources/safety-security-and-operations/manpower-report-2015-executive-summary
3. Sailing Forward: Felix Oca leads PAMI for Second Term. 2nd ed, vol. 45 (2017)
4. Lapena, C.: Court of appeals nullifies TRO on CHED closure order on deficient PMI programs. GMA News Online (2013)
5. Mes, J.: The Philippines and the EMSA Audit, a glass half full or half empty? (2018). https://www.linked.com/pulse/philippines-emsa-audit-glass-half-full-half-empty-joost-mes
6. Manila Times Acting Marina Chief Says: Compliance Docu's Now with EMSA (2018). https://www.manilatimes.net
7. National Center for Transportation Studies University of the Philippines Diliman: Economic Impact of Traffic Congestion in Metro Manila. National economic Development Authority (NEDA) Legislative-Executive Development Advisory Council (LEDAC) Final Report (2000)
8. Galic, S., Lušić, Z., Pusic, D.: Seafarers market. Int. J. New Trends Arts Sports Sci. Educ. 3rd ed. **1** (2012)
9. Richter, L.: The impact of the maritime industry on the Philippine economy, German-Philippine chamber of commerce and industry, Inc. (2016). https://philippinen.ahk.de/fileadmin/AHK_Philippinen/Publications/Maritime_Industry_in_the_Philippines__GPCCI_2016_pdf
10. TESDA: The Philippine maritime industry through the years, labor market intelligence report (2017). http://www.tesda.gov.ph>LMIR>MARITIME(2017)
11. Galvez, T., Tuapin, G., Sabay, B., Starke, R.: Study on the contribution of the PHs maritime education and training education to the GDP (2016)
12. Hapal, D.: Cash Remittance of Filipino Seafarers May Exceed $6B this Year Lawmaker (2018). https://www.rappler.com.nation
13. MARINA Statistical Report 2012–2016 (2017). http://marina.gov.ph/wp-content/uploads/2018/08/statistical-report-2012-2016_final.pdf
14. United Nations: Education-United Nations Sustainable Development. https://www.un.org/sustainabledevelopment/education
15. OECD: Better Policies for Better Lives, OECD Future of Education and Skills 2030. https://www.oecd.org/education/2030-project/
16. Marino World: A Special Report: The Shipboard Training Crisis, Volume XII, No. 3 (2017). https://issuu.com/marinoworld/docs/marino_world_may-june_2017_digital

17. Congress of the Philippines, Republic Act No. 10635: An Act Establishing the Maritime Industry Authority (MARINA). Sixteenth Congress, First Regular session, 13 March 2014. https://www.marina.gov.ph
18. President of the Philippines: Executive Order no. 63, Further Straightening the Authority of the MARINA as the Sole Administration of the Implementation of STCW as Amended (2018)
19. Joint CHED-MARINA Memorandum Circular No. 02, Series of 2019, Guideline on Joint CHED-MARINA evaluation and inspection of higher education institutions applying for government authority to operate Bachelor of Science in Marine Transportation and/or Bachelor of Science in Marine Engineering Programs (2019)
20. Inclusive Education Canada: What is inclusive education? (2017). https://inclusiveeducation.ca/about/what-is-ie/
21. Social Science UP Diliman. https://www.journals.upd.edu.ph/index.php/socialsciencediliman
22. UNESCO: Rethinking Education: Towards a common Good? UNESCO, Paris (2015). http://unesdoc.unesco.org/images/0023/002325
23. Congress of the Philippines, Republic Act no. 10931: Universal Access to Quality Tertiary Education Act. Seventeenth Congress, First regular sessions (2017). https://www.officialgazette.gov.ph/downloads/2017/08aug/20170803-RA-10931-RRD.pdf
24. CHED: Supports Broadest Access to Higher Education (2016). https://ched.gov.ph/press-releases/ched-supports-broadest-access-higher-education/
25. Statistics-CHED: Statistics infomatics, Archived Statistics, Higher education Statistical data 2019, ASEAN Indicators (2019). https://ched.gov.ph>statistics

Negotiating Gender Identities from Ship to Shore

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Abstract. Research on work and gender identity is still scarce in different occupational groups. This study focuses on seafaring professions on cargo ships where women's representation remains low globally. Various gender-related challenges associated with work on board faced by women were reported; however, it is not well understood how women seafarers cope with the transition from ship (work) to shore (home) in terms of their gender identities. Based on 36 in-depth interviews, the research found that women's gender identities may be conflicting when moving from ship to shore. During vacations, the cases revealed negotiation of gender identities in their local communities ashore. Such extra challenges for women affected their seafaring careers. The study identified a lack of understanding and support of complex socio-cultural issues concerning women seafarers ashore.

Keywords: Gender identity management · Women seafarers · Maritime industry · Place/Space · Gender roles

1 Introduction

Maritime transport workers are traditionally men while women's participation in maritime labour remains low. Women seafarers represent only 1% of the total seafaring population [1] and this figure has not changed in the last 27 years [2]. Barriers to working on board have been reported, for example, access to training, gender discrimination, sexual harassment, work-life balance and lack of role models and mentors [3]. Most studies on women seafarers focus on either education or workplace; however, their experience in shore communities is rarely discussed.

This paper addresses how women seafarers experience their transition from ship to shore and how their gender identities are managed in the shore community. The study is contrasted with the previous research on women seafarers' shipboard identity management [4] and focuses on their challenges ashore. When women seafarers work on board, in many cases with all male crew, their gender identities may be negotiated, constructed, maintained, and reproduced in order to adjust themselves to the work environment [4]. What will happen when women sign off the ship and return to their shore community where the gender ratio is fairly equal, unlike on ships? What does a place like shore mean to them? In order to investigate these questions, 40 in-depth interviews

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with women seafarers were conducted internationally. This paper presents the key results from a qualitative analysis using the software Nvivo.

The paper is structured as follows: Sect. 2 discusses gender, identity, and place; Methods used in this research are detailed in Sect. 3 and the key findings are presented in Sect. 4; Finally, the conclusions are in Sect. 5.

2 Gender, Identity, and Place

Linda McDowell published a book called 'Gender, Identity, and Place: Understanding Feminist Geographies' in 1999 [5]. According to her work, places are more than physical or spatial surfaces, but in fact codify "proper place" for each gender. As a consequence, some men or women may be disqualified from a certain place because of their sexuality, ethnicity, nationality or class. Becoming "out of place" creates uncertainty for people's identities [5]. Her work is influential in the contemporary societal challenges where people are increasingly mobile for work and some migrations are forced by wars and conflicts, climate change, and other factors [6].

In this context, seafaring is an occupation in which seafarers regularly cross the boundaries of two places: ship and shore. The norms and values on ships reflect hegemonic masculinity where women tend to be excluded as the male place disqualifies women [4]. However, in this challenging work environment, women seafarers exist, though not many. Women seafarers are the minority among the crew [7] as their representation is considered to be 1% [1]. Women as a minority in the workplace have been documented in various male-dominated occupations, in particular Science, Technology, Engineering and Mathematics (STEM) fields [8]. In such a place, occupational identities as well as gender identities are constantly being negotiated and re-shaped [4, 8].

A previous study identified that women seafarers managed their gender identities while on board [4]. Their gender identities appear to be in conflict with the norms and values characterised by masculine culture on board. On the other hand, very little is known about women workers' identity issues ashore. Gender identities managed by women seafarers while on board may encounter different kinds of conflicts when they come ashore. Do women seafarers who have moved from shore to ship find themselves finally moving back from "improper" to "proper" place?

3 Methods

The study followed a qualitative research approach commonly used in feminist research [9]. Qualitative in-depth interviews were conducted by snowball sampling. Due to the scope of the research investigating the identity issues of women seafarers in the extremely male-dominated workplace on board, the data collection focused on women in marine operation departments of cargo ships.

In total, 36 women seafarers were interviewed: German (n = 11); Ghanaian (n = 1); Japanese (n = 2); Polish (n = 1); Portuguese (n = 9); and Swedish (n = 12). Interviews were audio-recorded and transcribed by the researcher. Transcribed data were analysed by the qualitative software, Nvivo.

4 Findings

In this short paper, women seafarers' identity management ashore is discussed in two shore-based periods: in port and on vacation. Seafarers often work on vessels from weeks to months. When the ship arrives at port, duty officers remain on the ship to handle loading/unloading of cargos. The rest of the crew may be permitted to visit ashore near the port, usually for several hours. A vacation refers to a proper shore leave between voyage contracts, which often lasts weeks to months.

4.1 In Port: Retrieving Femininity

For all seafarers, a shore leave in port means more than access to shops and restaurants; it means psychological well-being. In the case of women seafarers, it can provide an opportunity to maintain their feminine identities which could potentially be suppressed in the male-dominated shipboard space. A Swedish deck officer, Sofia, felt that her femininity was retrieved by wearing make-up when she went out for a short shore visit in port:

> Only time I feel like a woman when I am aboard is when I put up my make-up and go ashore. (Sofia, Age 25, Junior deck officer, Swedish)

However, their brief joy in being feminine could attract male colleagues' attention with unwanted comments, as illustrated by a German Deck officer trainee, Gloria:

> When you go ashore, then you took out your normal clothes. That is normal. But also when I wear my normal clothes, then they looked at me, "Hey, what is going on?" He knows who I am and what is wrong? Then they told me "Oh you look so nice." Then you feel you are like a "thing". What happened? I am still Gloria and I am a student here. Not a girl who wants to have a relationship to somebody in. This is what I hate. (Gloria, Age 22, Deck officer trainee, German)

A shore leave in port requires women seafarers to cross the border from a male-dominated ship to a gender-balanced shore. At this border, women tended to experience discomfort in being stared at or having their feminine appearance commented on.

4.2 On Vacation: Negotiating Gender Identities

Unlike port visits, longer shore leaves provide a variety of opportunities to visit favorite places and meet friends and families. Though it is still temporary, women seafarers are no longer strangers in port but often have expected roles in relationships with their families and/or lovers. A German deck trainee, Marina, explained how difficult it was for her to show emotions and care to her boyfriend ashore:

> Because two weeks ago, I came back from the vessel. So uh, actually in the relationship it is the most difficult thing. Because on the vessel, I always have to make my way for myself. So I never showed my emotions and feelings, anything. … Then you are coming back and there's somebody you have to take care. You

> have to show your emotions. And you also want to show your emotions, but it is not so easy, because you are not so used to it any more. (Marina, Age 22, Deck officer trainee, German)

When women seafarers spend their careers at sea, their behaviors and attitudes could be influenced by the maritime professions, which might cause some communication problems with shore-based people. A Swedish deck officer, Norah, explains:

> I encounter problems sometimes with both men and women that feel insecure in relation with me, because I am not perhaps predictable in a way that more confined personality would be. (Norah, Age 43, Senior deck officer, Swedish)

Further cases were reported by mother seafarers who had difficulty making themselves feel like mothers when they returned from ship to shore. One of the examples was the retired radio officer, Rose, from Portugal who shared her challenge in feeling like a mother:

> I got a job shore-side, starting a new time. And the youngest one is 6 years old. (…) For this one, I feel myself as a mother, because I was emotionally going on. The other ones…well…they were born and then I saw them in ten years old…. It's very strange because in some ways, I am not exactly a mother. Sometimes I am the oldest sister or even the sister around their age. So, we have problems with them making myself feel as a mother. (Rose, Age 45, Radio officer, Portuguese)

Because of a long absence at sea, a Ghanaian Captain, Sisi, also encountered a problem with her children, who did not see her as a mother, and eventually she decided to leave the sea. Sisi explained:

> When you tell them to do something, they have to go and ask their father. I was jealous, you know. How? If I told them to do something, why should they go? And if they want to cry, they go to their father to cry. You know. Why not come to me? I am your mum!
>
> (Sisi, Age 52, Captain, Ghanaian)

Such conflicts in women's gender identities are rarely shared and often individually coped with. To promote maritime careers to young women, it will be helpful to establish a support system through school, employment, and professional networks.

5 Conclusions

The research found that some women seafarers experience challenges in relation to their gender identities when shifting from ship to shore. Narratives derived from the interview data depicted how women seafarers' gender identities were in question between two places: ship and shore. The paper analysed their challenges in two shore settings: in port and on vacation. A short port visit provided a temporary opportunity for many women seafarers to display their femininity by using makeup and feminine clothes. On the other hand, a vacation seemed to require a degree of negotiation in their gender

identities as their gender roles in the shore community might carry expectations in relation to their families, friends, and lovers. Their shore-based community can become an "improper" place for some women seafarers. In many cases, such women's challenges were individually coped with as they perceived that no one could understand them. In this study, the lack of understanding and support of complex socio-cultural issues related to women seafarers ashore was identified. Such extra challenges for women may affect their seafaring careers. A support system through school, employment, and professional networks would be helpful in terms of attraction and retention of women seafarers.

References

1. BIMCO, ICS: Manpower report: The global supply and demand for seafarers in 2015. London, Maritime International Secretariat Services Limited (2016)
2. Kitada, M.: Advancing "good practices" that promote gender equality in the maritime sector. In: Papanicolopulu, I. (ed.) Gender and the Law of the Sea. Brill, Leiden (2019)
3. WMU: Third WMU International Women's Conference on Empowering Women in the Maritime Community: Conference Report. World Maritime University, Malmö (2019)
4. Kitada, M.: Code of behaviour at sea: women seafarers' shipboard identity Management. WMU J. Marit. Aff. **12**(2), 213–227 (2013)
5. McDowell, L.: Gender, Identity, and Place: Understanding Feminist Geographies. University of Minnesota Press, Minneapolis (1999)
6. Abel, G.J., Brottrager, M., Cuaresma, J.C., Muttarak, R.: Climate, conflict and forced migration. Glob. Environ. Change **54**, 239–249 (2019)
7. Kitada, M., Langåker, L.: Women seafarers as minority organizational members. In: International Association of Maritime Universities (IAMU) General Assembly. 26–29 Oct, Haiphong, ISBN 978-604-937-120-2 (2016)
8. Kvande, E.: 'In the belly of the beast': constructing femininities in engineering organizations. Eur. J. Women's Stud. **6**, 305–328 (1999)
9. Maynard, M., Purvis, J. (eds.): Researching Women's Lives from a Feminist Perspective. Taylor & Francis Ltd., London (1994)

The Future of Innovation Management – Symbiotic Interaction Between Humans and Cognitive Systems

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Abstract. In times of digital transformation and often-disruptive markets, companies have to continuously optimize their existing business models and at the same time promote new products and services as well as organizational structures and working processes. Human creativity in combination with artificial intelligence and cognitive systems are key enablers for organizations to optimize their business and better predict and control their innovation processes. Optimized symbiotic interaction between humans and machines needs a methodological approach in order to design and evaluate enhanced innovation processes for generating new ideas and implementing innovative hybrid working scenarios. In this paper, the authors present key elements for the optimization of innovation processes based on established creativity techniques and potentials of cognitive systems.

Keywords: Artificial intelligence · Cognitive systems · Creativity techniques · Design methodology · Human-machine collaboration · Hybrid activities · Innovation methods · Symbiotic interaction

1 Introduction

Nowadays, the competitiveness of companies more and more depends in particular on their innovative strength. Due to ongoing digitalization, shorter innovation cycles and disruptive markets, companies have to question established processes and structures, including their own products and services as well as business models, constantly developing them further and, if necessary, fundamentally revising them. The basis for this is the analysis, integration and transfer of knowledge – as the central asset of the future – within companies and in cooperation with partners. New technologies, algorithms, interconnectedness and big data are reshaping our working world and business from the ground up. Not only the integration and utilization of innovative technologies and business models matter, but it is essential to understand the interdependencies and impacts on the fundamentals of innovation management – the interaction between the determinants, technology and people [1, 2].

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2 Current Creativity Techniques and Systems

Research on innovation puts creativity at the heart of business [3]. The success of new product development efforts depends to a great extent on the creativity of the underlying ideas. Creativity is commonly defined as the production of new ideas ("Exploration") that are both original and valuable, and innovation is the implementation of these ideas into new products and processes ("Exploitation"). Hence, creativity is viewed as the first stage of an innovation process, followed by implementation. [4] Creativity techniques can contribute to stimulating thought processes in the search for solutions and to widening the range of solutions. These can thus increase the probability to find an optimal solution for a given task. The difficulty lies in developing exactly the ideas that drive companies forward and can also be implemented by employees. Here the problem often is not quantity, but quality [5].

Generally, there are five types of common creative techniques. These can briefly be characterized according to the following formative idea-generating principles:

- Free association techniques: Mutual free association in the group;
- Structured association techniques: Mutual association in the group within a given structure;
- Confrontation techniques: Confrontation with unproblematic aspects. Elements of the creative process for generating ideas are recreated;
- Configuration techniques: Systematic modification and confrontation;
- Imagination techniques: Developing of inner images.

During application the strict separation of the divergent phase (idea generation) and the convergent phase (idea evaluation and selection) must be observed for all creativity techniques. In the 1990s, computer programs have already been developed for the application of creativity techniques, which can provide assistance e.g. in the recording, analysis and evaluation of ideas. However, these were often limited to the processing and visualization of the human input. Understood as from human input dependent, the following key promising potentials and basic restrictions of the respective techniques overall can be identified from the authors' point of view as presented below:

Key promising potentials:

- Identification and determination of current and future-oriented needs and requirements based on intuitive association;
- Bringing in ideas regardless of their value or applicability and easily picking up and combining them;
- Networked thinking due to interdisciplinary composition of the participants and through the involvement of external experts;
- Consideration of a multitude of factors with influence on new products, services or business models;
- Improving transparency and acceptance of new solutions through joint development.

Key basic restrictions:

- Lack of innovative approaches, newness and uniqueness (participants only looking at the problem from one perspective, working on one solution only or ideas often very close to already existing and solutions and easy to realize without any revolutionary changes);
- Danger of excessive systematization for systemic pronounced techniques;
- Subjective objectivity of participants (one person's behavior can affect the ability of the entire group to act creatively);
- Necessity of guidance to change thinking style due to little prior experience of the participants from educational back-ground of making decisions based upon openness and risk taking;
- High expenditure in personnel, organizational and time terms.

In order to overcome the restrictions of common creativity techniques, agile practices with the creation of self-reliant, self-managing teams have been promoted in a targeted manner complementing the traditional organizational structure. In this context, interdisciplinarity plays a major role in the performance of such teams and its exchange must be recognized, established and filled with new life as an innovation driver. Small steps that build on each other with manageable risk and resource deployment help to gain experience, build competencies and find out what works for companies.

For this, development methodologies are commonly used in creative and innovative professional settings. By applying "Design thinking" human users can go beyond the typical "analysis – design – implementation – testing" process, to reinterpret it with the "emphasize – define – ideate – prototype – testing" [6]. Scenario methods, as a further example, lead to holistic stories illustrating visions of possible futures or aspects of possible futures for new products, services or business models [7]. Furthermore, gamification can serve as one possible way to support collective creativity since it increases amusement, engagement and immersion in activities [8].

With the complexity of problems transcending the individual human mind – computational systems supporting collective creativity on the basis of artificial intelligence (AI) technologies are developed performing creative tasks in collaboration or isolated. Such creative systems can enable a wide range of tasks with similarly wide variety of roles for human participants (Fig. 1).

There are three main strategies emphasizing the role of humans in creative systems: (a) fully autonomous systems, (b) creativity support tools, and (c) co-creative systems shortly presented below [9]:

- Fully autonomous systems are built to generate creative artifacts that are judged by users to be creative. These systems are based on a variety of technologies, from corpus-trained statistical learning techniques, to production rules, to evolutionary approaches or planning based systems, all designed to produce output that is judged as creative by some evaluation process.
- Creativity support systems are tools and applications that are built in order to support the user's creativity. These can be defined as tools that develop the creative thought

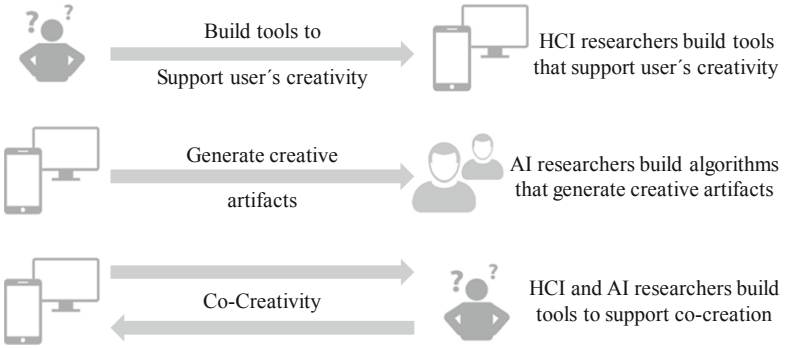

Fig. 1. Main trends in creative systems [9]

of users and allow them to be both productive and innovative supporting simplicity, wide range of exploration, and different paths and styles.

- Co-creativity enables that computers and humans collaborate with each other to build shared creative artifacts. It involves different types of collaboration (e.g. division of labor, assistantship or partnership) between multiple parties where at least one of the parties is an AI agent. In these systems, each agent has to perceive other agents' contributions and express its own creative ideas through autonomous action.

In co-creativity, there are more than one participants contributing to the creative process, but often the specific contribution of each participant cannot be delineated [10]. Especially co-creative systems in the author's opinion promise considerable added value in generating ideas and solving problems combining the strengths of humans and computational systems based on AI.

3 Towards Innovation Management of the Future: Symbiotic Interaction

Companies must continuously optimize their existing business models, at the same time allow, and promote new products, services and organizational developments. Nevertheless, how can this balancing act between efficiency and flexibility and between strategic and operative activities be achieved? New technologies, such as data analytics, cognitive systems and AI, as well as data-based business models and platforms, are changing our value creation systems from the ground up. It can be approached as disruption in a very dedicated way. And disruption means that everything must and will be completely different, completely new afterwards. Companies therefore need to contribute to overcoming the diverse challenges by means of innovations.

Whether manufacturers, logistics companies or health care organizations: digitalization is penetrating more and more areas and changing the tasks and activities of workers [11]. Rule-based and repetitive tasks are increasingly performed or supported by machines, e.g. by usage of assistive exoskeleton robotics [12] or intelligent language assistants. However, this applies not only to blue-collar workers, but also many areas

of the white-collar workers' work also leading to a considerably change in innovation – both in strategic and operative perspectives.

It is therefore foreseeable that the need for new forms of human-machine collaboration will increase considerably heading for a new division of labor and within innovation processes between people and technology according to specific strengths. Learning algorithms and big data in combination with human creativity enable organizations to optimize their business and better predict and control their processes and applications [13]. Corporate information, which in the past was mainly based on human knowledge or only accessible digitally in limited ways, now can be captured, shared and enriched via co-creative computational systems and assistive technologies can increase human capabilities and productivity (Fig. 2).

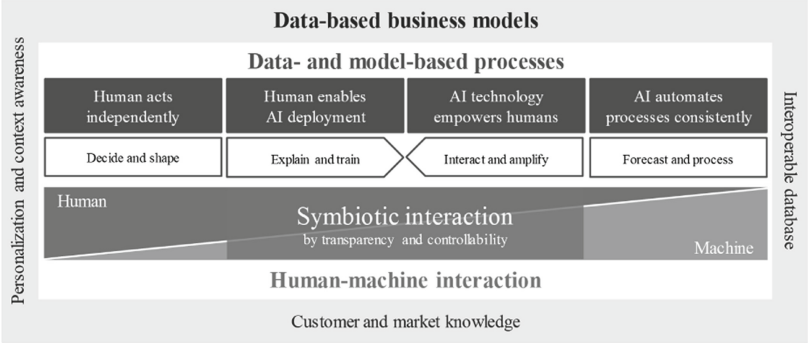

Fig. 2. New rules for human-machine interaction and collaboration

However, optimized interaction and collaboration between humans and machines still needs further research in order to design and evaluate enhanced innovation processes for generating new ideas and implementing innovative hybrid working scenarios based on a methodology representing the main objective of our research work. The hybrid approach as the core of this methodology is as follows: "hybrid" means that human and technical intelligence are acting in a co-creation. The identified key questions underlying the methodology and supporting the design of the specific innovation process are as follows:

- What are the main criteria for the specific strategic or operative innovation process (aims and metrics)?
- How can innovation in the specific phase be supported (creativity techniques/innovation methods and/or computational tools)?
- What is the impact of AI in the specific innovation process (development and/or application)?
- Which actor dominates the evaluation (humans or technical systems/agents)?
- What is the suitable structure (successive or collaborative)?
- Between which innovation phases feedback is appropriate for the purpose of continuous process improvement and how is it designed?

4 Conclusion and Future Work

The digital transformation of strategic and operative processes by the establishment of new hybrid forms of human-machine interaction and collaboration represents a pioneering development, which is still at the beginning. The methodology to be developed should make a significant contribution to raising existing potentials and enabling companies to realize them in a demand-oriented and comprehensible way.

References

1. NTT Limited: Future Disrupted: 2020 technology trends (2019)
2. Förster-Metz, U.S., Marquardt, K., Golowko, N., Kompalla. A., Hell, C.: Digital transformation and its implications on organizational behavior. J. EU Res. Bus. **2018**, Article ID 340873 (2018). https://doi.org/10.5171/2018.340873
3. Waters, B: Innovation trends report 2019, Stanford University (2019)
4. Revilla, E., Rodríguez-Padro, B.: Building ambidexterity through creativity mechanisms: contextual drivers of innovation success. Res. Policy **47**, 1611–1625 (2018)
5. Mioskowski, H., Meyer J.-E.: Unternehmen brauchen Ideenprofis! Wie sich geniale Ideen mit System entwickeln lassen. Ideenmanagement **4** (2013)
6. Corral, L., Fronza, I.: Design thinking and agile practices for software engineering. In: Association for Computing Machinery. SIGITE 2018, Fort Lauderdale, FL, USA, 3–6 October 2018 (2018)
7. Sarpong, D.: Scenario planning: methodologies, methods and shifting conceptual landscape. Int. J. Foresight Innov. Policy **10** (2016). https://doi.org/10.1504/ijfip.2015074397
8. Satu, P., Hyypiä, M.: Innotin game supporting creativity in innovation activities. J. Bus. Res. **96**, 26–34 (2019)
9. Karimi, P., Grace, K., Maher, M.L., Davis, N.: Evaluating creativity in computational co-creative systems (2018)
10. Jordanous, A.: Co-creativity and perceptions of computational agents in co-creativity (2017)
11. Bauer, W., Schlund, S., Vocke, C.: Working life within a hybrid world – how digital transformation and agile structures affect human functions and increase quality of work and business performance. In: 8th International Conference on Applied Human Factors and Ergonomics (AHFE 2017) and the Affiliated Conferences, AHFE 2017, Los Angeles, USA (2017)
12. Constantinescu, C., Todorovic, O., Ippolito, D.: Comprehensive modelling and simulation towards the identification of critical parameters for evaluation of exoskeleton-centred workplaces. In: 12th CIRP Conference on Intelligent Computation in Manufacturing Engineering, CIRP ICME 2018, Neapel, Italy, Procedia CIRP, vol. 79, pp. 176–179 (2018)
13. Vocke, C., Bauer, W.: Work in the age of artificial intelligence – challenges and potentials for the design of new forms of human-machine interaction. In: 10th International Conference on Applied Human Factors and Ergonomics (AHFE 2019) and the Affiliated Conferences, AHFE 2019, Washington D.C., USA (2019)

Integrated Human-Centered Performance Management on the Shop Floor

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Abstract. This paper presents an empirical study based on the business game simulation method to investigate relationships between gamified metrics-based information provisioning on the shop floor, operational performance and work motivation. For this purpose, we transferred our human-centered performance management approach from previous research into an assembly application scenario. This scenario framed the study design content wise using the method of business game simulation. To this point, we conducted the developed business game amongst 135 trainees in technical vocational schools in Germany. Initially, the obtained data is evaluated with respect to operational performance using descriptive statistics. The findings provide first evidence that metrics-based information provisioning might positively affect operational performance in terms of reworks and errors compared to no information provisioning.

Keywords: Human-centered · Sociotechnical · Production systems · Performance management · MES · Industry 4.0 · Internet of production

1 Introduction

Industry 4.0 entails the digitalization and interconnection of key technologies, cyber physical systems and the human factor in sociotechnical production systems [1]. With the concomitant change of the organization of work in such systems, the demand for comprehensive information provisioning increases – particularly in direct areas such as the shop floor [2]. In this regard, available data on operations has to be adequately processed in order to generate insights for shop floor personnel, i.e., workers and supervisors. Moreover, both personnel groups need to be motivated and empowered to use these insights efficiently [3]. With respect to related work, literature review in our previous work [4] showed that neither approaches to shop floor management (e.g., information boards), nor performance management systems (e.g., key performance indicator systems), nor

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gamification applications are designed to deliver comprehensive and motivating information to the shop floor level. To address this issue, we developed a human-centered performance management approach in form of a gamified metrics-based dashboard, which we briefly present in Sect. 2. Using manual assembly as an application scenario for our approach, Sect. 3 presents the design of an empirical study to investigate effects of information provisioning and gamification with regard to operational performance and work motivation. Section 4 comprises preliminary study results in terms of descriptive statistics. Section 5 closes with a conclusion and implications for the research in progress.

2 Human-Centered Performance Management

In our previous articles [4, 5], we developed a human-centered performance management approach as an integral module of manufacturing execution systems (MES). The approach and its technical realization are briefly described in the following. Next, we present an application scenario, which serves as a basis for the study design.

2.1 Approach

The human-centered performance management approach comprises information provisioning based on a key performance indicator system (KPI) and their graphical visualization on a digital dashboard – optimized for mobile device view. Additionally, a widget with a team leaderboard can be added to create a gamified version. The KPI system is based on a survey study and structured according to the hierarchy of the integration model described in norm IEC 62264. Two versions, i.e., for workers and supervisors, were developed to address the specific underlying information needs. Visualization of data was realized as a mobile dashboard using literature-based design principles. Finally, we propose a points-based team leaderboard as gamification element to be incorporated in the approach as this has been shown to be particular applicable in production environments. Technical realization of the approach is based on a client-server architecture and comprises three modules: data collection, data consolidation and analytics, visualization. The latter represents the client and is realized as a web application. The server-side back-end comprises the first two modules and relies on the generic architecture of MES.

2.2 Application Scenario

MES systems are already used in many areas of production today. However, the assembly process as an essential step in value creation poses specific challenges related to MES deployment. Assembly is characterized by high manual effort with either repetitive and identical work tasks (e.g., batch or continuous production) or highly complex operations decisive for individualization (e.g., discrete production) [6]. This requires both efficient process design and comprehensive worker guidance. The latter is particularly difficult within manual assembly with focus on manual task performance [7]. A large part of companies does not employ IT systems, i.e., MES, to collect and process assembly-specific data automatically and near real-time. Hence, information transparency is limited and

its provision back to the shop floor delayed [8]. These challenges support the assumption that MES is capable to make an essential contribution to operational performance in manual assembly. Hereby, operational performance is defined by a target system with conflicting dependencies on quality, costs and adherence to delivery, which are all subject to assembly complexity, i.e., function of variant diversity and lot size [9]. In a discrete manual assembly scenario, our proposed MES module incorporating the human-centered performance management approach becomes relevant once an order or operation has started. Through metrics-based information provisioning in a visualized form, it is ensured that both workers and supervisors are comprehensively informed of the current process step, the overall status of the assembly process and the target achievement. On that basis, we present two hypotheses:

- *H1:* Application of our proposed MES module increases operational performance as well as the work motivation of workers (supervisors respectively).
- *H2:* Application of our proposed MES module including additional gamified elements intensifies the effects on performance and work motivation.

3 Empirical Study

This paper focuses on a problem with practical relevance and implications. As such, we adopt the research process of applied science by Ulrich [10]. In order to test the hypotheses from Sect. 2.2, we employ the business game simulation method. The methodological approach is presented hereinafter. Current results are limited to the worker version of the MES module and focus on operational performance effects.

3.1 Research Approach

By definition, a general-purpose business game is a highly complex synthetic environment. Its underlying objective is to offer an authentic situation to engage the subjects in a simulated experience of the reality [11]. As business game simulations strive to be as realistic as possible, the behavior observed may be generalized. Compared to laboratory experiments, business game simulations achieve both higher fidelity and external validity [12]. The main criticism posed on business games created for research purposes is oversimplification of real world interactions. Most research designs only involve a single subject facing rather uncomplicated problems. Furthermore, it is criticized that the practicing of the business game situation, e.g., familiarization and use of certain game elements, consumes a large portion of the restricted time for study conduction.

3.2 Research Design

The research design comprises the game setup, treatment groups, subjects, procedure and pre-test. These aspects are presented in the following.

Game Setup. The business game is based on the application scenario presented in Sect. 2.2. In particular, we consider a manual assembly line with three subsequent workstations for 25 assembly variants of ‘Fischertechnik’ miniature trucks (test object). Four

modules, i.e., platform, mounted applications, chassis and special equipment, with two to four different components per module characterize its generic structure. Further, each product is customized in terms of component numbers. As the total number of components ranges from 18 to 36 components per truck, also the complexity varies. This is the only determinant of variant complexity as the assembly of the components relies solely on plug connections. Based on this, we divided the variants into two complexity classes using the median value (30) of components. The assembly line is structured as follows. The first workstation includes order entry and material supply. The sequence of orders is randomized in terms of complexity classes. Further, each order contains exactly one test object variant. Material supply is realized with a small-parts shelf that contains all components of the test object. The remaining workstations both constitute an assembly area as well as storage spaces for incoming and outgoing orders. Assembly of the modules 'platform' and 'mounted applications' is assigned to the second workstation; assembly of the remaining modules takes place at the third workstation. Each workstation is equipped with a tablet device showing a treatment screen. Finally, the game setup provides a quality control section where the final test object is checked for completeness and accuracy. The game's objective is given by the definition of operational performance presented in Sect. 2.2. Execution of the game requires participation of three subjects. Additionally, two examiners, i.e., research associates, are required for conducting the simulation. One examiner is responsible for quality control; the other examiner observes the subjects using a standardized observation sheet.

Treatment Groups. Investigation of the presented hypotheses requires three different treatment groups: (TG1) reference, (TG2) metrics-based information and (TG3) gamification in addition to metrics-based information. The three groups differ only in the content displayed on the tablets. In all other aspects, the game setup is identical. Subjects of TG1 receive a plain screen with buttons for order registration and data entry for rework. The screen of TG2 includes the operational worker dashboard with widgets that visualize the KPIs lead time, rework rate, error rate and the current output number of finished test objects. These KPIs are presented together with static benchmark values calculated from pre-test averages and are measured on team level. TG3 receives the same dashboard as TG2. In addition, a team leaderboard widget was included. A maximum of three points is awarded per test object, i.e., one point each per object finished, object finished without any errors and object finished faster than the benchmark. Earned points are added up to determine the leaderboard position.

Subjects. The study targets manufacturing shop floor workers, i.e., personnel directly involved in the execution of operations. Our sample is based on trainees with at least two years' shop floor experience.

Procedure. The procedure of the business game simulation includes four subsequent phases. First, the *introduction phase* serves to welcome the subjects. This includes a brief presentation of general information about the business game as well as the random assignment of participants to the workstations. Additionally, a treatment is randomly assigned to the group. Next, the *familiarization phase* explains the game setup as well as the underlying rules using a standardized video of approx. 5 min. Additionally, 5 min are

granted to the subjects to familiarize themselves with the setup including all materials, e.g., tablet device, test object, order flow. Afterwards, the *game phase* starts. This phase represents a working shift in which a theoretically infinite number of orders is processed. The shift duration is 27 min, divided into 15 min working time, 2 min break and 10 more minutes working time. The first work period is 5 min longer, because that is the average time it takes until the assembly line is filled with orders. During the game phase, communication between the subjects is strictly forbidden in order to exclude potential effects of personal communication. However, this rule does not to apply to the break time as this period is intended for detailed examination of the current KPI values within the team. Finally, the simulation closes with the *survey phase*. A paper-based survey is handed to the subjects for measuring their work motivation (cf. Sect. 3.3.). After survey completion, the subjects are released.

Pre-test. Apre-test was conducted to verify the study settings and materials. The pre-test included 10 groups consisting of the same target subjects as in the main study. It was mainly directed towards comprehensibility of the game setup and the procedure. A final version of the business game incorporated minor changes to phrases in the order documents of the test object variants.

3.3 Data Collection

We use two different data collection methods for measurement of operational performance represented by key performance indicators and work motivation. Measurement of *operational performance*, represented by the defined key performance indicators, is accomplished automatically by our MES module. The underlying game setup is capable to automatically collect unix timestamp data of order registration, rework count, error count and number of finished products. These numerical data types were used for KPI aggregation. Data for measuring the variable *work motivation* was collected using a paper-based questionnaire based on Bjoerklund's scale [13]. Additionally, the survey included questions about the subjects' demographics and their experiences in manual assembly work. Data collection started in September 2019 and is still in progress. As of end of December 2019, our sample was derived from seven different vocational schools for technical occupations in Germany. In order to eliminate external effects regarding location and time, the game has been set up identically in each school. To this point, the sample consists of 135 trainees, i.e., 45 groups, with 4.2% female participants.

3.4 Data Analysis

For data analysis we used the software Minitab 18. Before analysis we inspected the data regarding unique identifiers, missing data, outliers, and distribution. Data inspection showed no irregularities. To this point, we analyzed the operational performance data on order level (N) using descriptive statistics with means (M), medians (Med), standard deviations (SD) and ranges (R).

Table 1. Descriptive statistics for indicators 'lead time', 'number of reworks' and 'number of errors' across the treatment groups.

Indicator	TG	Complexity Class 1					Complexity Class 2				
		N	*M*	*SD*	*Med*	*R*	*N*	*M*	*SD*	*Med*	*R*
Lead time	1	37	7.951	2.277	7.267	8.650	39	7.883	1.503	7.767	6.267
	2	83	6.371	1.762	6.017	8.433	100	7.732	2.331	7.300	14.117
	3	94	7.172	2.008	6.583	9.733	100	8.348	2.483	7.925	11.750
Reworks	1	37	1.297	1.266	1.000	4.000	39	2.205	1.824	2.000	6.000
	2	83	0.542	0.887	0.000	4.000	100	0.550	1.086	0.000	7.000
	3	93	0.819	1.218	0.000	5.000	100	0.770	1.377	0.000	8.000
Errors	1	37	1.216	1.635	0.000	6.000	100	1.462	1.354	1.000	4.000
	2	83	0.325	0.734	0.000	4.000	39	0.600	1.092	0.000	5.000
	3	94	0.914	1.932	0.000	10.000	100	1.460	2.134	0.000	9.000

4 Preliminary Results

The three indicators of operational performance, i.e., 'lead time' (in minutes), 'number of reworks' and 'number of errors', were analyzed with descriptive statistics (Table 1). Results for *lead time* show slight differences between the three groups within the lower complexity class. While TG1 yields the highest median (7.267), the value for TG2 is about 1.250 and TG3 about 0.750 lower. However, for the higher complexity class, the differences between the highest (TG3) and lowest (TG2) median values are only 0.625. This corresponds with observations made during the business games. As soon as the complexity of the test object increased, the subjects focused more on the work task and less on the supportive tablet device. Additionally, the ranges of lead time values are higher for TG2 and TG3 compared to TG1 in the higher complexity class. This may indicate that no provision of information may lead to less distraction of the subjects during the mere work task execution, thus resulting in 'better' performance with respect to lead time. With respect to the *number of reworks*, the medians for TG2 and TG3 are 0.000 for both complexity classes. In comparison, the median value for TG1 is 1.000 (lower complexity class) respective 2.000 (higher complexity class). This observation may imply two aspects. First, subjects of TG2 and TG3, both receiving informational feedback on reworks, may pay higher attention on the first time right assembly of the components. This in turn, results in low values of the indicators, i.e., mean and median. Second, the generally low numbers in rework may show that the complexity of the chosen test objects is too low for both classes, which results in overall low variances. Finally, analysis of indicator *number of errors* shows a similar result as for the previous indicator. Here, even the median of TG1 is 0.000 for the lower complexity class. This supports the suggestion that overall complexity of the test object may be too low. With regard to the means, TG1 (1.216 and 1.462) and TG3 (0.914 and 1.460) achieve similar values in both complexity classes, whereby standard deviation is lower for TG1. Subjects from TG2

on average commit 0.325 errors in the lower complexity class and 0.600 in the higher class indicating this treatment is better off in terms of errors.

5 Conclusion and Future Research

In this paper, we presented the design of an empirical study to test our previously developed human-centered performance management approach with respect to its effect on operational performance and work motivation. For this purpose, we employed a business game simulation approach and hitherto conducted an empirical study amongst 135 trainees with manufacturing shop floor experience. Preliminary data analysis with respect to lead times show slight differences for test objects with lower complexity. In this case, information provisioning seems to improve performance. In the higher complexity class, differences between the groups are diminishing. The preliminary results suggest that no information provisioning might be beneficial, which might be explained through less distraction. Moreover, the data indicate that the provision of information may be slightly beneficial in order to reduce the number of reworks and errors in both complexity classes. After completion of the study, statistical significance in the observed differences between the treatment groups needs to be formally tested. Additionally, also data regarding work motivation needs to be evaluated in order to investigate the proposed hypotheses.

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References

1. Metzmacher, A.I., Hellebrandt, T., Ruessmann, M., Heine, I., Schmitt, R.H.: Aligning the social perspective with the technical vision of the smart factory. In: Schmitt, R.H., et al. (eds.) Advance in Production Research: 8th WGP Congress, pp. 715–729. Springer, Berlin (2019)
2. James, T.: Smart factories. Eng. Technol. **7**(6), 64–67 (2012)
3. Groeger, C., Stach, C., Mitschang, B., Westkaemper, E.: A mobile dashboard for analytics-based information provisioning on the shop floor. Int. J. Comp. Int. Manuf. **29**(12), 133–1354 (2016)
4. Hellebrandt, T., Ruessmann, M., Heine, I., Schmitt, R.H.: Conceptual approach to integrated human-centered performance management on the shop floor. In: Kantola, J.I., et al. (eds.) Advance in Human Factors, Business Management & Society, vol. 783, pp. 309–321. Springer (2019)
5. Hellebrandt, T., Ohlig, J., Poetters, P., Heine, I., Leyendecker, B., Schmitt, R.H.: Integration of human-centered performance management into manufacturing execution systems. In: Proceedings of 53 CIRP Conference on Man System, Chicago, 1–3 July (2020, in press)
6. Wannenwetsch, H.: Integrierte Materialwirtschaft, 5th edn. Springer, Berlin (2014)

7. Lotter, B., Wiendahl, H.-P.: Montage in der industriellen Produktion. Springer, Berlin (2006)
8. Unrau, A.: Projektionsgestützte Assistenzssysteme in der manuellen Montage, REFA (2016). https://refa.de/blog-industrial-engineering/435-projektionsgestuetzte-assistenzsysteme-in-der-manuellen-montage. Accessed 22 Jan 2020
9. Norm VDMA 66412-40: MES in the Framework of Industrie 4.0. Beuth, Berlin (2018)
10. Ulrich, H.: Die Betriebswirtschaftslehre als anwendungsorientierte Sozialwissenschaft. In: Dyllick, T., Probst, J.B. (eds.) Management, pp. 168–199. Bern, Stuttgart (1986)
11. Garris, R., Ahlers, R., Driskell, J.E.: Games, motivation and learning: a research and practice model. Simul. Gaming: Interdisc. J. **33**(4), 441–467 (2002)
12. Lainema, T., Makkonen, P.: Applying constructivist approach to educational business games. Simul. Gaming: Interdisc. J. **34**(1), 131–149 (2003)
13. Bjoerklund, C.: Work motivation-studies of its determinants and outcomes. Doctoral Dissertation. Stockholm School of Economics (2001)

Digital Technology. A Tool for Development of Human Capital in Mexican Industry (Theoretical Approach)

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Abstract. Nowadays, we are immersed in a world of information, a world of increased and unprecedented interdependence and complexity that is causing a radical alteration of our way of communicating, acting, thinking and expressing. In this young century, companies whose specialty cannot adapt to a constantly changing environment are destined to crash course over time. Digital technologies have created a new scenario for human thinking, learning and communication, have changed the nature of the tools available for thinking, acting and expressing. Technology is part of a knowledge environment that will determine the future of resources in teaching and the dissemination of knowledge, leading to important changes in the sustainability and development of the same knowledge. For the Mexican economy, it is necessary to make adjustments and adaptations to absorb the knowledge that foreign companies bring, seeking to make intellectual capital one of its pillars of growth. That is why in order to achieve efficient management it is necessary to make an analysis of the technologies that the world is implementing to boost the growth of Mexican companies.

Keywords: Technology · Digital technology · Training · Mexican industry

1 Introduction

From early years of the 21st century, many authors foreshadowed the changes that digitalization and new technologies would bring to the current world. The world economy has entered an era with vertiginous changes: the information age, bringing with it an increase in interdependence and complexity in relationships, causing a radical alteration in the way in which people communicate, act, think and they express themselves. Technology is having a great impact on how companies are managed, organized and financed [1]. It is understandable if we consider it as an inherent part of the current globalized world that represents benefits to industry, science, transfer of financial and satisfying resources to everyday populations.

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Pérez Gómez [2] analyzes the acceleration in the evolution of human beings where, as mentioned, symbolic development and information management were responsible for a cumulative and exponential effect on the evolution of human beings. The hominization took several million years; nomadic prehistory almost a million years; the agricultural time seven thousand years; the industrial era did not reach 300 years; and the digital era is barely 50 years old.

The 21st century is related to technology and how to take advantage of the potential generated by it and, one of them is the way in which human talent is managed. Organizations will have continued pressure to address the skills and competencies gap, talent retention, attrition rates and workforce participation, among other urgent issues.

As for obtaining and applying knowledge, skills and attitudes (knowledge and know-how) and recruitment services, social networks are key and increasingly indispensable [2]. Already in 2008, Alessandro Baricco cited by Pérez Gómez, mentioned that the internet was producing a "cultural mutation" where there is a loss of information value and its source of knowledge.

2 Technology and Digital Technologies

Thus, the digital technologies applicable to communication (Internet, forums, chats, blogs, youtubers, among others) have generated profound and rapid changes in the dissemination of information in previously unimaginable ways. Social networks have key drivers and increasingly indispensable for obtaining and applying knowledge, skills and attitudes as well as being key factors for staff recruitment services.

In the era of digital information and the Internet, the world on the screen is a very different world from the world of the written page. It requires a very different intellectual, perceptive, associative and reactive life. A new intellectual ethic is born which defines what we consider valid knowledge as well as the ways it is obtained, distributed or consumed [2]. Pérez-Gómez, quotes Carr (2010) who states that we live submerged in an ecosystem, Internet, of disruption. Digital technologies as opposed to the technology of the printed book that favored concentration.

Riegle already considered in 2007 certain peculiarities of digital technology:

- Most of the valuable information is on the web: Libraries, museums, encyclopedias, research centers, databases, repositories, blogs.
- Information that is not yet available on line, and is truly useful and valuable, can be accessible by uploading it.
- Each new paradigm changes or emphasizes a new concept of valuable information medium or scenario. In the oral era, the narration; in the era of writing and printing, the texts, and in the digital age, multimedia.
- The principle of immediate and global access facilitates the exchange of information, and stimulates motivation, contrast, can favor current debate and criticism, but also the banal transit along the path of novel information.

Digital technologies have had a profound impact on the economic systems of many companies. Organizations that know what digital technology is for and have applied it

have seen its benefits in reducing costs, optimizing processes, processing and effective analysis of information and strengthening business communication. All this supposes a competitive advantage over other companies, allowing the development of innovative systems in all the processes of an organization [3].

With this perspective, the first thing considered as the most appropriate was to identify and locate existing technologies or those that are under developed. As result of this research, we present the attached analysis charts where, the first thing done was to classify technology as physical (tangible) or digital (implies interaction with ICT). Finally, it was studied the development tools and the characteristics that identify those technologies [4] (Tables 1 and 2).

Table 1. Physical Techniques and technologies (Castillo, P & Valencia, R. 2018).

Technology	Tool	Description
Physical Techniques and Technologies	Process Involved	This kind of "training is made" between the instructor and the apprentice using virtual classrooms as well as software applications, a blackboard and uses instant polling technology (immediate voting)
	Action Learning	This type of training holds that learning is better when experimenting, when doing. It gives the work teams or groups a real problem, makes them work to solve it and commit as an action plan, and then makes them responsible for carrying out the plan. Novartis and GE use this training
	Walkabout	The Asian Institute of Management in Manila developed this method. In this training, the knowledge generation is left to each person and requires a minimum investment
	Basic challenges	This method uses creativity and adventure to develop practical skills, logical curiosity is required
	Skill use	This model involves seeking opportunities, goal setting, strategy formulation, planning and implementation

Table 2. Digital techniques and technologies (Castillo, P & Valencia, R. 2018).

Technology	Tool	Description
Digital technology (Information and Communication - ICTs)	Smart tutorials	These systems use artificial intelligence. Customize the training experience to meet the needs. There are three types of systems: mentoring, training and empowerment
	Immersive reality	This technology is based on the recreation of real spaces with which to interact. Reality normally photographed through 360-degree cameras and other techniques, in order to accurate detail reality, for further exploration. The use of immersive reality can reduce travel costs, get inside tiny objects or ensure dangerous environments
	E-Learning	It is the web-based system, allows distance learning, and uses virtual reality methods and access to learning portals, gives access to training courses, services and learning communities
	Virtual reality	It provides a three-dimensional training system, allows realistic simulations stimulating the senses of the apprentice. Use audio interfaces, vision and gloves to stimulate the sense of touch
	Learning games	These are games designed to help people learn about certain subjects, expand concepts, reinforce development, understand a historical event or culture, or assist them in learning a skill as they play. Games are interactive play that teach us goals, rules, adaptation, problem solving, interaction, all represented as a story

(*continued*)

Table 2. (*continued*)

Technology	Tool	Description
	Augmented reality	This technology provides extra content within reality, expanding information. It allows adding layers of visual information about the real world around us, using the technology of mobile devices such as mobile phones
	Diminished reality	It is a concept related to the tools that allows us to remove objects from a scene that is observed through a device
	Machine Learning (AI)	Discipline of **artificial intelligence (AI)**, which uses sophisticated algorithms that allow computers to "learn" large amounts of data without being explicitly programmed (SAP, 2018)
	Happy technology	These technologies propose that, through sensors incorporated in parts of the equipment used (gloves, clothing, accessories), be able to emulate the sense of touch

3 Training

Many organizations in the world today provide their associates with opportunities to learn and use "adequate training" strategy as a retention tool and seek to obtain quality results from their employees. Not only have they increased their investment in "training and development practices" of employees, but they have also systematized training policies and practices from the analysis of training needs to their evaluation and feedback.

The new technological systems have given a way to a much more complete Human Resources management that allows not only guaranteeing the administration of the area but also to manage the commitment of the collaborators and analyze their potential and performance to generate personalized action plans. It is increasingly necessary to link technology not only with people management but also as a tool to improve the work performance of staff as well as systematize the available know-how [5].

As technology advances, so does the nature of training. Currently, companies are increasingly relying on training such as simulation or training in virtual spaces (physical or computer generated), which have become critical as companies seek to become more cost efficient and more effective training.

Today, new approaches to the use of computer-based technology (CBT) and peripherals with a focus on training are emerging and developing [6]. Perhaps, investments in equipment and development may be high at first, but the benefits in training time and the quality of the information shared would bring greater benefits to organizations.

Perhaps, investments in equipment and development may be high at first, but the benefits in training time and the quality of the information shared would bring greater benefits to organizations. However, it is an area of opportunity little exploited even in Mexico and that can bring benefits in the short and medium term.

4 Challenges for Mexico

Among the challenges that Mexico faces for the implementation of digital technologies, is the inherent need for the use of internet connection and its technical performance, since it is an essential characteristic for the operation of these technologies.

According to the analysis made by García for the magazine El Economista in 2019 on the data presented in the ENDUTIH survey from INEGI, users mention problems such as slowness in the transfer of information (51.9%), excess information (19%), viruses' attack (12.4%), information fraud (3.3%) and privacy violations (3.1%) [7].

Although in Mexico 90% of internet users, use it for entertainment and communication, there is an interesting figure also presented by INEGI and that is that 83.6% of users occupy their connection for education/training (83.6%) [8].

Another of the challenges that digital era has brought is that young people are permanently connected to the web, nobody doubts it, however this keeps them saturated with information and demanded by multiple demands of plural social networks and they are getting used to dispersing and occupying your attention between different simultaneous tasks: multitasking. They rarely do one thing at a time, devoting partial attention to each of the tasks, and demanding communication and instant gratification, which can undermine their patience and increase their anxiety, given the lack of habit for waiting or delay [2]. This is something that, when developing new forms of job training, it is necessary to take into account.

5 Conclusion

The world of technology advances rapidly, the ideal goal would be to maximize the transformative properties of the technology and minimize its possible misuse. The 21st century has marked a trend in corporations, thanks to the access of mobile devices; this has caused a need to find technological aids that allow keeping control of business not only from a PC but also from a Smartphone or Tablet. The technological tools not only allow us to have an integral vision on the fulfillment of goals and strategies of the area, but also give us access from any place and at any time [5].

If the significant use of technology democratizes knowledge, potentializes the development of skills in users, and can be considered an opportunity for Mexican companies. Investing in new and better ways to train staff with digital technology as an option that can bring advantages to different actors. ICTs modify processes, expand capacities and productive potential and make some operations easier.

It is then that technology becomes an ally of companies when it comes to selecting, retaining, developing and training talent in an appropriate and personalized way. The use of a technological would allow many companies installed in Mexico, go further in the relationship with employees, take control of their process within the company and identify their strengths to potentiate them and their weaknesses to train them.

References

1. Schwab, K.: La cuarta revolución industrial. Debate, México (2016)
2. Pérez-Gómez, A.: Educarse en la era digital. Morata, Madrid (2012)
3. Group, E.A.: Para qué sirve la tecnología digital: evolución, ejemplos e impacto (2019). https://blog.enzymeadvisinggroup.com/para-que-sirve-la-tecnologia(2012)
4. Castillo, P., Valencia, L.: Perspectiva para uso de tecnología en la Industria Automotriz Mexicana. Memorias del Congreso Internacional de Investigación Academia Journals Celaya 2018, pp. 770–774. Academia Journals, Celaya (2018)
5. Editorial Glocal Thinking: La tecnología como aliada de los Recursos Humanos (2017). https://www.glocalthinking.com/la-tecnologia-como-aliada-de-los-recursos-humanos
6. Suhasini, R., Suganthalakshmi, T.: Emerging trends in training and development. Int. J. Sci. Res. Publ. **5**(3) (2015)
7. García, A.: 7 datos acerca de los usuarios de internet en México. El economista (2019). https://www.eleconomista.com.mx/tecnologia/7-datos-acerca-de-los-usuarios-de-internet-en-Mexico-20190414-0004.html
8. Notimex: Así usan Internet los mexicanos, según el Inegi. El Economista (2019). https://www.eleconomista.com.mx/tecnologia/Asi-usan-Internet-los-mexicanos-segun-el-Inegi-20190515-0090.html

Internationalization Agendas in Higher Education. A Dutch – Russian Perspective

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Abstract. The endeavor to establish a faculty leadership by shaping the best practices in strategic planning of the internationalization process is the major contribution to knowledge of this study. From a conceptual perspective, different levels of internationalization are examined within this research, trying to associate these levels to the general background of institutional strategic planning concerning globalization and internationalization agendas. The present study seeks to fill the gap in research regarding the manner of implementation at the HAN University of Applied Sciences (Arnhem Business School), the Netherlands and Plekhanov Russian University of Economics, Russia regarding the goals of internationalization agendas. This comparative study brings into the light best practices to be learned from and it describes how the objectives of internationalization processes are achieved. The approach to learning from best practices creates not only awareness but also develops new learning practices that could be implemented to enhance the global competitiveness.

Keywords: International agendas · Quality of higher education · University global competitiveness · Internationalization policies

1 Introduction

In order to reach the aim of this study, several main objectives are drawn. First, in order to achieve the requirements of the internationalization process set by both countries, the Dutch and the Russian higher education landscape and policies are analyzed. The next objective is to emphasize the mentioned universities that have proved the potential to reach the aims and objectives of the internationalization process, but also to lay out the traditions and particularities of these HEIs institutional cultures and approaches to internationalization. How the deficiency of policy implementation at the state level is impacting the results of internationalization at the institutional level is revealed based on the results acquired under the previous paragraphs.

Consequently, this approach looks at the trends regarding new developments in the internationalization policies at the universities that are reviewed, which implies also the

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research regarding institutional history, statistics and traditions. A comparative approach was developed based on the available data regarding internationalization: data such as domestic reports, statistics, world university rankings and different data available at the university websites in order to describe the internal institutional climates of the chosen HEIs.

In the recent years, internationalization of higher education is a topic studied in many countries around the world as a consequence of globalization in higher education. Globalization at the level of higher education institutions has contributed to increasing the mobility of students, teachers and resources. The internationalization of higher education takes different facets around the world. Due to these, there are discrepancies between higher education institutions (HEIs) in different countries. Therefore, this study addresses the need to understand the differences in the internationalization process of higher education conducted for different studies and researches. The existence of an institutional strategy, agenda or policy in the universities represents a core element in the progress of internationalization of higher education and the existence of this kind of policy in universities presents significant discrepancies among universities in various parts of the world [1]. That is why this article is focusing on the comparative study regarding the existing agendas and policies of Arnhem Business School, the Netherlands and Plekhanov Russian University of Economics, Russia; to emphasize the importance of reflecting and learning from best internationalization practices at institutional level.

Due to this, comparative studies and best practices case studies are needed to explore the specifics and learning from significant differences between higher institutions as Plekhanov Russian University of Economics and HAN University of Applied Sciences (Arnhem Business School), the Netherlands. The authors believe that this approach to learning from best practices (both formal and informal) creates not only awareness but also develops new learning practices that could be implemented by both institutions to enhance the global competitiveness.

2 Literature Review

The many papers were published in the last years in the field of internationalization of higher education institutions. Moreover, an important number of relevant articles focused on international cooperation and the improvement of international education and research through internationalization have been disseminated. However, internationalization as a topic studied in scientific publications has significant differences in the Netherlands and in the Russian Federation.

The topic of internationalization of higher education in Russia is rarely researched in scientific publications. There are only a few such publications that analyze the process of internationalization from different perspectives. The institutional arrangements in the Bologna Process implementation are studied by Shenderova (2011) in relation to the development of multi-level degree system in Russia [2]. The Russian-European double degree programs have been look into literature in terms of achievement or deficiency inside a university is investigated by analyzing the factors leading to success or failure [3] as well as the regulative context of joint programs development as elements of the internationalization of higher education activities [4]. The context of leadership

and rankings as competitive environments for the university cultures is discussed [5] while in the situation of changing Soviet and Post-Soviet economy and society, the progress and understanding the position of higher education is being also relevant in the literature [6]. Still, very little is known about the subject of internationalization agendas as comparative studies. Therefore, the urgent need for comparative studies on internationalization agendas and internationalization of higher education activities is calling for this present study.

The Netherlands, on the other hand, has a relatively long tradition of having an international outlook in its higher education because the country has a relatively small population and a strong desire to attract students [7, 8]. This outlook is in a large part also attributable to the wider culture as the Netherlands depends for a large part on export and international connections [9]. As a result, when the EU called for an increasing internationalization and academic mobility, the Netherlands followed immediately [10]. A more significant move of the internationalization of higher education is that courses are increasingly offered in English both to make the universities more accessible to international students, and to prepare Dutch students better for potential international careers [11]. A further dimension of how Dutch higher education institutions internationalize is through increasing academic mobility and exchanges [9]. Indeed, between 2006 and 2014 the number of incoming international students increased by 70% while the number of outgoing students increased by 80% [12] and there is no indication that this trend is stopping soon.

According to the CBS population prognosis, between 2024 and 2030 the percentage of the Dutch student population will decrease by 5%, and almost all graduates from the Dutch higher education institutions are finding a job very quickly [13]. If policy in internationalization in Dutch higher education does not change in the following years, this trend is predicted to continue. If this trend will continue, then the numbers of international students attending the Universities of Applied Sciences will have a small growth, while a notable growth at research universities is expected. Nowadays the number of Dutch students is balanced, but on a long term is expected to fall slightly [14].

There are some critical voices in the Netherlands about this increasing internationalization of higher education however [7]. There are worries that it might decrease the quality of the education because Dutch lecturers are expected to teach in English when they are not native speakers. As a result, the worry is that neither the lecturers nor the students will be able to do their work on the same level. However, there is mixed evidence about whether this actually has negative effects [11]. This is further supplemented by increasing anti-international and anti-immigration sentiments in the Netherlands which fight against the idea of unlimited growth of international students and education [7]. A counter-reaction is so-called internationalization at home which focuses more on teaching knowledge and respect for other cultures, and teaching students to thrive in international environments [9]. Indeed, it seems that the best way to meet the demands of critics is to increase the quality of internationalization instead of focusing on attracting as many international students as possible [7].

The topic of internationalization of higher education in the Netherlands is vastly researched in scientific publications. However, comparative studies between the Netherlands and Russian higher institutions regarding internationalization progress at institutional level considering education agendas, strategies and policy is not deeply studied.

3 Results and Outcomes

The Based on the proposed research designed and the documentation analyzed, we were able to reach the results and outcomes of our research. Since this is a comparative study regarding the internationalization process of higher education institutions in the two countries, namely the Netherlands and the Russian Federation, the results and outcomes are presented for each country based on the research of previously mentioned sources of data. Universities around the world live in a competitive environment, where resources and prestige drive institutional strategies and behaviors. That is a reality that cannot be denied or avoided. This complex higher education environment requires a higher level of introspection and honesty both within institutions and among partners [15]. That is why the need for both Plekhanov and Han to share experiences, policies and agendas and learn from best practices.

HAN University of Applied Sciences (Arnhem Business School) internationalization agenda concerns both issues organized and/or facilitated at central HAN level, and issues that need to be addressed at institute and course level. The latter issues need to be approached in ways appropriate for the relevant professional field and the occupations students are being trained for, while at the same time making a contribution to the HAN-wide ambitions and objectives. The internationalization agenda in no way hinders the "local" shaping of such issues; on the contrary, this agenda provides the framework and conditions to support it. "We are aware that the setting of ambitions should go hand in hand with setting concrete objectives and accompanying indicators, and that these ambitions cannot be achieved in the absence of sufficient funding. This agenda will therefore also serve as a guide for the budget 2016–2020" [16]. Internationalization Agenda 2018–2019 of Arnhem Business School is based on concrete and specific strategic points and pillars [17]:

1. Internationalization of the curriculum
2. EPAS International accreditation
3. Personnel and internationalization
4. Research Centrum CARIB
5. Student recruitment
6. Cooperation with international professional field

This agenda also aims to create the frameworks and conditions that enable HAN to work in the long term towards obtaining the certificate of the European Consortium for Accreditation in Higher Education (ECA) for internationalization at institution level. The preparations to achieve such an international quality label can benefit the internal dynamics of the institution. Because internationalization improves the quality of education and

research, the institution must systematically and professionally examine its vision, policy and implementation of internationalization: the vision that underpins internationalization, the policies developed and the ways in which they are implemented throughout the institution. The process the institution must undergo in order to obtain the internationalization certificate is helpful in this regard. The internationalization ambitions set out in the Institutional Plan 2016–2020 largely need to be addressed and implemented into a decentralized manner. Central services, such as the International Office, play a coordinating role as needed to improve efficiency or to guarantee clarity and consistency towards students and staff [16–18].

At Plekhanov Russian University of Economics (PRUE) until 2013 internationalization was not considered as a significant factor of competitiveness. It was a duty of the International Office to proceed applications of foreign students and to organize student and staff exchange programs. International Office worked in cooperation with faculties and sometimes with academic departments but still was functionally isolated. International cooperation in the field of science and research was not well established and no real need for that existed. The share of foreign student was about 3%; the share of foreign lecturers (visiting only) was less than 1%. Only two faculties had programs delivered in English (2–3 at the BSc level and 3 at the MSc level). One of those faculties attempted in 2011 to obtain EPAS International Accreditation but failed some of the criteria at the institutional level [19].

In 2012 Russian Government announced new Russian Academic Excellence Project 5-100. Although Plekhanov University was not included into this project, administration took decision to increase international competitiveness of the university and to use Project 5-100 framework. In 2013 first internationalization concept of the Plekhanov University was developed [19]. Internationalization strategy in 2016 was included as an integral part of the PRUE Strategic Development Program for 2016–2020 [20]. At Plekhanov University the Internationalization strategy 2018–2019 is based on the following goals:

1. Improving the quality, attractiveness and competitiveness of educational services of the PRUE at the global and national levels;
2. Enhancing the reputation and value of research activities of the PRUE at the global and national level;
3. Ensuring effective participation of the PRUE in the global processes of development of science and education;
4. Increasing the share of income from export of educational and research services.

Increasing international partnerships and the international elements of research and education is based on several important arguments. Higher education institutions should enhance international cooperation in order to improve the quality of research by the chance to collaborate with researchers from different countries. By doing this, the field of research may be enriched. On the other hand, the quality of education can be also enhanced through exchange of knowledge and experience during international partnerships. Requirements like creating international comparisons and analyze these comparisons help students to observe the content of education into a larger context. Moreover, students are ready for working life due to the internationalization in higher education. Nowadays, the impact of internationalization and globalization is increased in society

and in the labor market. Based on this situation, international and intercultural aspects help all students to be prepared for society and the labor market, both for the present and for the future. There are various arguments for which the activities of higher education institutions should develop into international partnerships in order to bring benefits for the entire society.

4 Conclusions and Further Research

Cooperation and knowledge transfer in education and research receive more significant attention in countries that are developing as knowledge intensive societies. In bilateral partnerships with different countries and cooperation within the EU, education and research represent core domains. Bilateral relationships are improved by many countries using as an instrument the science diplomacy. Moreover, an essential role in the improvement of the assistance policy can be played by research and higher education. Some of the international challenges the world is facing nowadays can be surmounted by in-depth research collaboration. Both national and international sustainable developments are decisively influenced by the internationalization of higher education. Additionally, increasing internationalization has also several economic arguments. Innovation system is essential to the society growth and economic development. Since higher education and research are contributing significantly to the innovative system, these institutions are vital components for the society as whole. Any country that attracts foreign students, researchers and experts who choose to remain in that country after graduating can gain numerous benefits.

Consequently, internationalization brings vital benefits of cultural and social importance. An increasing number of forms of cooperation and networking are characteristic for the wide field of internationalization of research and higher education. Worldwide partnerships and internationalization benefit from many new opportunities such as the increasing in global mobility of people, values, knowledge, ideas, innovations and money. At the same time, between nations and higher education institutions is a tight competition for skills and resources.

References

1. Egron-Polak, E., Hudson, R.: Internationalization of Higher Education: Growing Expectations, Fundamental Values: IAU 4th Global Survey. International Association of Universities, Paris (2014)
2. Shenderova, S.: Multi-level Higher Education Institutional Arrangement in the Russian Federation: The Formation and Development Monograph, St. Petersburg State University Economics and Finance (2011)
3. Karpukhina, E.: Russian-European double degree programs: key factors of success. In: Kuder, M., Lemmens, N., Obst, D. (eds.) Global Perspectives on International Joint and Double Degree Programs, pp. 139–149. Institute of International Education, New York (2013)
4. Burquel, N., Shenderova, S., Tvorogova, S.: Innovation and Transformation in Transnational Education. Joint Education Programmes Between Higher Education Institutions of the European Union and Russian Federation. Final Report. European Union, Brussels (2014)

5. Pavlyutkin, I., Yudkevichm, M.: The ranking game on the Russian battlefield: the case of the higher school of economics. In: Yudkevich, M., Altbach, P., Rumbley, R. (eds.) The Global Academics Rankings Game, Changing Institutional Policy. Practice and Academic Life. Routledge, Abingdon (2016)
6. Smolentseva, A.: Where Soviet and neoliberal discourses meet: the transformation of the purposes of higher education in Soviet and post-Soviet Russia. High. Educ. **74**, 1091–1108 (2017)
7. Altbach, P., De Wit, H.: Are we facing a fundamental challenge to higher education internationalization? Int. High. Educ. **2**(93), 2 (2018)
8. Schäfer, G., El Dali, Y.: Trajectories into foreign higher education systems for doctoral candidates from Germany: a comparative study of France and The Netherlands. Compare: J. Comp. Int. Educ. 1–17 (2019)
9. Bastiaannet, H.: Internationalization in senior secondary vocational education in The Netherlands. In: Tran, L., Dempsey, K. (eds.) Internationalization in Vocational Education and Training. Technical and Vocational Education and Training: Issues, Concerns and Prospects, vol. 25. Springer, Cham (2017)
10. Kaleja, K., Egetenmeyer, R.: Internationalization in European vocational education and training. In: Tran, L., Dempsey, K. (eds.) Internationalization in Vocational Education and Training. Technical and Vocational Education and Training: Issues, Concerns and Prospects, vol. 25. Springer, Cham (2017)
11. Breetvelt, I.: English-medium instruction in Dutch higher education: a policy reconstruction and impact study, vol. 18, pp. 1–24 (2018)
12. Van Oijen, A., Noorderhaven, N.: Higher education in management: the case of The Netherlands. In: The Future of Management Education: Volume 2: Differentiation Strategies for Business Schools (2017)
13. Hoger Onderwijs Persbureau: Plussen en minnen (2017)
14. Huberts, D.: Analyse stayrate van internationale afgestudeerden: 2007–14. Nuffic, The Hague (2016)
15. Green, M.: Measuring and Assessing Internationalization. NAFSA, Association of International Educator, Washington, DC (2012)
16. HAN University of Applied Sciences: Institutional Plan 2016–2020
17. HAN University of Applied Sciences: Strategical Internationalization Agenda 2016–2020
18. HAN University of Applied Sciences: Policy Memorandum on Internationalisation Faculty of Business, Management and Law (FEM) 2016–2020. Exploring the world, enhancing your skills
19. Plekhanov Russian University of Economics: The concept of internationalization (2013)
20. Plekhanov Russian University of Economics: Strategy Program 2016–2020

Rethinking Higher Education Through Sustainable Development Goals (SDGs): A Russian Perspective

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Abstract. This article aims at providing a 0.0 measurement and assessment of how Plekhanov Russian University of Economics, Russia perceives the importance of their impact on society, education and various stakeholders. Based on and using The University Impact Rankings 2019 by Sustainable Development Goals: quality education methodology, the author is making a starting point in a comprehensive analysis to explore Plekhanov university impact rankings for individual SDGs. He starts with the SDG 4 (Quality Education) as it seems the most relevant measurement and assessment tool at the moment. The present study seeks to fill the gap in research regarding the manner of implementation at mentioned university regarding the SDG goals and describes how the objectives of internationalization processes are determined by the higher education regulations and policies inside the HEIs.

Keywords: Rethinking higher education · Quality of higher education · University global competitiveness · Sustainable development goals

1 Introduction

The United Nations Agenda 2030, with its 17 Sustainable Development Goals (SDGs) [1], is the perfect point of departure when rethinking higher education. These goals should be imbedded in universities collective responsibility and inspire all of the stakeholders involved to envision a new role for universities in achieving high quality education for all. According to Helen Clark, former prime minister of New Zealand and former head of the United Nations Development Programme, in her keynote speech at the 2019 International conference 'Rethinking Higher Education: Inspired by the Sustainable Development Goals', universities carry a paramount role in educating students in order to create a sustainable future society [2]. She emphasizes that universities possess different roles, have the capacity for cross-disciplinary research and teaching in advocating the importance of implementing the sustainable global goals at different levels: governmental, local and institutional.

The concept of Quality Education has been mentioned and discussed by many scholars and different definitions for various purposes have been proposed with quality seen "in light of how societies define the purpose of education" [3–6].

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For the practicality reasons and uniformity with Plekhanov's international accreditation agendas, this article is following the Quality Education Metrics presented by The University Impact Rankings 2019 by SDG [7]:

1. Research on early years and lifelong learning education (27%)
2. Proportion of graduates with teaching qualification (15.4%)
3. Lifelong learning measures (26.8%)
4. Proportion of first-generation students (30.8%)

In line with the quality education metrics model mentioned and taking into account the explorative nature of the study, the researcher chose a combination of targeted expert interviews (at Plekhanov Russian University of Economics), archives and observations, with main emphasis on the first two (same methodology used for previous article regarding mapping, measuring and assessing Internationalization) [8].

2 Results and Outcomes

At Plekhanov Russian University of Economics (PRUE) until 2013 internationalization was not considered as a significant factor of competitiveness. It was a duty of the International Office to proceed applications of foreign students and to organize student and staff exchange programs. International Office worked in cooperation with faculties and sometimes with academic departments but still was functionally isolated. International cooperation in the field of science and research was not well established and no real need for that existed. The share of foreign student was about 3%; the share of foreign lecturers (visiting only) was less than 1%. Only two faculties had programs delivered in English (2-3 at the BSc level and 3 at the MSc level). One of those faculties attempted in 2011 to obtain EPAS International Accreditation but failed some of the criteria at the institutional level [9, 10].

In 2012 Russian Government announced new Russian Academic Excellence Project 5-100. Although Plekhanov University was not included into this project, administration took decision to increase international competitiveness of the university and to use Project 5-100 framework. In 2013 first internationalization concept of the Plekhanov University was developed. Internationalization strategy in 2016 was included as an integral part of the PRUE Strategic Development Program for 2016–2021 [9, 10].

At Plekhanov University the Internationalization strategy is based on the following goals:

1. Improving the quality, attractiveness and competitiveness of educational services of the PRUE at the global and national levels;
2. Enhancing the reputation and value of research activities of the PRUE at the global and national level;
3. Ensuring effective participation of the PRUE in the global processes of development of science and education;
4. Increasing the share of income from export of educational and research services.

To achieve the first goal, the following objectives are established:

- formation of a package of educational programs based on prospective requirements of the Russian and international labor market;
- promotion of comprehensive statistical and qualitative information about PRUE educational programs and student services;
- development of the infrastructure and institutional conditions for the mobility of students, teachers and researchers.

To achieve second goal, the following objectives are established:

- identification of priority areas of research activities based on trends and requirements of the Russian and world economy;
- promotion of comprehensive statistical and qualitative information about PRUE research activities and services;
- engagement of PRUE researchers to present results of their projects at the international level (conferences, publications, including co-authorship);

To achieve the third goal, the following objectives are established:

- increase of the level of integration of the research and educational processes at PRUE at various levels (exchange and double degree programs, expert communities, professional associations);
- improve of the quality and value of PRUE membership in international and regional organizations, projects, programs and processes (including promotion of the educational programs and research possibilities);
- dissemination of the information of PRUE achievements in the field of science and technology, including educational technologies and methods;
- expansion of the opportunities for foreigners to learn Russian language and to research Russian history, the Russian language, Russian literature and culture.

To achieve the fourth goal, the following objectives are established:

- formation of monitoring system of a demand and supply of educational services at the national and global markets;
- participation in the governmental and companies' initiatives for foreign staff development;
- participation in international rankings, comparative studies, development of collective documents and recommendations of international organizations and associations;
- cooperation with the national governmental and national and international non-governmental agencies to promote Russian education, organizations the recruitment of foreign citizens to Russian universities;
- modernization of the institutional regulations regarding international activities (including the rules for admitting foreign students) in order to maximize the opportunities defined by the existing legislation of the Russian Federation;

– formation of a system of criteria for choosing a foreign partner (university, organization) in accordance with the strategic priorities of the PRUE development;
– creation of joint educational programs (exchange, double/triple diploma);
– training of the teaching staff and International Office staff;
– accreditation of PRUE educational programs in international associations;
– modernization of the content and mechanisms of mobility programs for students, teachers and researchers, inclusion of the branches of the university in the processes of international mobility;
– development of advanced training for foreign graduates of Russian universities.

To measure progress of the internationalization at the Plekhanov University, the following quantitative criteria are monitored:

– international students (% of the total), international teachers (% of the total),
– exchange students (per 100 of local students), double degree students, double degree programs,
– number of partner universities in top-500 of QS, THE and ARWU international rankings,
– joint research projects, number and share of publications in co-authorship with foreign partners,
– position in international rankings,
– number of publications indexed in international citation databases,
– level of satisfaction of foreign students,
– number of foreign applicants and students at Russian language foundation program.

Internationalization at the Plekhanov University demonstrates different progress in different fields. The most successful activity is the internationalization of teaching staff, share of foreign lecturers reached 6.5% in 2018. The number of international students more than tripled since 2013 and reached a share of 9.6% in 2018. At the same time due to unfavorable economic conditions (currency exchange rate) the number of outgoing exchange students did not grow at all and stopped at the level of around 290 students per year. Due to sanctions and political conditions number of incoming exchange students first dropped by 30% but then recovered by 2018 and reached level of 240 students per year [9, 10].

One of the most fast-growing activities in PRUE internationalization is recruitment of students for foundation program (Russian language and some general courses). If at the opening there were only 60 students, in just 3 years this number reached a level of over 280 students [9, 10].

Performance of PRUE at international accreditations (European Council of Business Educations, EdUniversal) and international rankings (QS World University Rankings, QS Stars University Ratings, QS Subject Rankings, RUR, UniRank, SCImago Institutions Rankings) demonstrated results just as expected so far.

International research collaborations appeared to be more difficult to develop. Although number of international research projects and the share of co-authored with foreign partners publications grow, it is still below expected level. PRUE administration

in 2018 took decision to finance international cooperation and facilitate process of joint research [9, 10].

After a thorough analysis of PRUE internationalization agenda, targeted interviews held al Plekhanov, the following 0.0 measurement and assessment (as from academic year 2018) was made based on The University Impact Rankings 2019 by SDG 4 Quality Education Metrics [7] (Table 1):

Table 1. SDG Quality Education Metrics at Plekhanov Russian University of Economics.

Number of graduates who gained primary school teaching qualifications
Metrics and Evidence
Number of graduates - **5932**
Number of graduates at ISCED 6 (Bachelor level) - **4505**
Number of graduates at ISCED 7 (Master's level) - **1245**
Number of graduates at ISCED 8 (Doctoral level) - **140**
Comment: All graduates with higher education have gained primary school teaching qualifications - **5932**
Lifelong learning opportunities provided
Metrics and Evidence
Provide access to educational resources for those not studying at the university, e.g. computers, library, online courses, access to lectures, etc? **https://online.edu.ru/ru/courses/item/?id=684** **https://online.edu.ru/ru/courses/item/?id=686** **https://online.edu.ru/ru/courses/item/?id=689**
Host events at university that are open to the general public: public lectures, community educational events? **https://www.rea.ru/ru/pages/additionaleducation.aspx**
Host events at university that are open to the general public: executive education programmes (this refers to short courses for people who are not attending the university; this specifically excludes courses like MBA) and/or vocational training? **https://www.rea.ru/ru/Pages/mba-dba-programs.aspx**
Undertake educational outreach activities (e.g. tailored lectures or demonstrations) beyond campus, e.g. in local schools, in the community, including voluntary student-run schemes? **https://cbsmedia.ru/rossiya/proforientatsionnaya-rabota-klyuch-k-uspekhu-vybora-professii-buduschikh-studentov/**
Have a policy that ensures that access to these activities is accessible to all, regardless of ethnicity, religion, disability or gender? **Yes. The University has such a policy. Internal document.**
Proportion of 1st Generation Students
Metrics and Evidence
Number of students - **16505** Number of students starting a first - **12573** Number of first generation students - **7756**

3 Conclusions and Further Research

Regarding the quality of Education in Higher Education, cooperation and knowledge transfer in education and research receive more significant attention in those countries that are developing as knowledge intensive societies. Bilateral partnerships with different countries and cooperation within the EU, where education and research represent core domains should be specified in international policies and agendas at institutional level for each university. Bilateral relationships are used to improve the international quality of education as many countries use it as an instrument for the science diplomacy. Some of the international challenges the world is facing nowadays regarding the quality of education can be surmounted by in-depth research collaboration. Both national and international sustainable developments are decisively influenced by the internationalization of higher education. Additionally, increasing internationalization has also several economic arguments. Innovation system is essential to the society growth and economic development. Since higher education and research are contributing significantly to the innovative system, these institutions are vital components for the society as whole. Any country that attracts foreign students, researchers and experts who choose to remain in that country after graduating can gain numerous benefits.

Consequently, barriers that may inhibit the optimal conditions for the higher education institutions to act at the international level and create favorable conditions for achieving the Sustainable Development Goals should be eliminated. In order to include the international perspective in different parts of the institutions and in order to consider internationalization as an integrated part of operations, at the executive management level of the higher education institutions a comprehensive and strategic effort should be made aimed to develop other successful objectives of institution's strategy. The link between education and research at local and wider international communities can be improved and enhanced due to the internationalization. Moreover, both education and research can be reinforced as a result of internationalization as the internationalization of research supports the internationalization of education and vice versa.

References

1. The United Nations Agenda 2030, Sustainable Development Goals (SDGs)
2. Helen Clark's Keynote Speech, International Conference 'Rethinking Higher Education: Inspired by the Sustainable Development Goals' (2019)
3. De Pauw, J.B., Gericke, N., Olsson, D., Berglund, T.: The effectiveness of education for sustainable development. Sustainability **7**, 15693–15717 (2015)
4. UNESCO: Global Monitoring Report 2013/4: Teaching and Learning: Achieving Quality for All. UNESCO, Paris, France (2014)
5. Laurie, R., Nonoyama-Tarumi, Y., Mckeown, R., Hopkins, C.: Contributions of education for sustainable development (ESD) to quality education: a synthesis of research. J. Educ. Sustain. Dev. **10**, 226–242 (2016)
6. Mochizuki, Y.: Rethinking schooling for the 21st century: UNESCO-MGIEP's contribution to SDG 4.7. Sustain. J. Rec. **12**, 88–92 (2019)

7. The World Education Rankings: University Impact Rankings 2019 by SDG: Quality Education. https://www.timeshighereducation.com/world-university-rankings/impact-rankings-2019-methodology-quality-education
8. Shtykhno, D., Popescu, F., Iskandaryan, R., Weber, T., Warmenhoven, R.: Mapping, measuring and assessing internationalization. A Dutch–Russian Perspective. In: Karwowski, W., Ahram, T., Nazir, S. (eds.) Advances in Human Factors in Training, Education, and Learning Sciences, AHFE 2019. Advances in Intelligent Systems and Computing, vol. 963. Springer, Cham (2020)
9. Plekhanov Russian University of Economics: The concept of internationalization (2013)
10. Plekhanov Russian University of Economics: Strategy Program 2016–2020

Exploring Critical Success Factors for Safety Management of Tanker Vessels

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Abstract. Managing modern merchant vessels is quite challenging task for shipboard personnel, as well as for shore-based managers in shipping companies. The risks are more so accentuated in terms of vessels that carry dangerous and volatile cargoes, such as tanker vessels. Modern industrial disasters have demonstrated that organizations have a considerable role to play in terms of ensuring adequate safety climate in day-to-day operations at the sharp end. This study explores Critical Success Factors (CSFs) that are necessary for tanker vessel managers to ensure that the ships operate as safe as possible. A literature review focused on the shipping industry and tanker vessels in specific, revealed CSFs such as – human factors, technical factors, environmental factors, organizational factors, regulatory factors, and economic factors, as well several sub factors. The results can provide a basis for further systematic analyses of the CSFs and how they are perceived by the shipping managers in their order of relative importance.

Keywords: Shipping · Safety Management System · Maritime operations · Critical Success Factors

1 Introduction

The shipping industry can be characterized as safety critical industry and the backbone of international economy. It is estimated that about 90% of the global trade takes place via sea [1]. Merchant ships carry a variety of cargo to destinations worldwide. Such cargo ranges from everyday products and shipments, such as standardized containers, grains, minerals, livestock etc., to some highly volatile and combustible products, such as crude oil, crude oil products and chemicals. The shipment of the latter naturally gives rise to additional challenges in terms of safety and risk management. Thus, such cargoes are transported by specialized ships known as tanker ships or tanker vessels. Tanker vessels can be classified into – crude oil tankers, product tankers, chemical tankers, and liquified gas tankers. Any accident involving tanker vessels may not only result in fatalities onboard, but also have consequences for the surrounding environment and general public, as they may result in oil spillage and environmental contamination. There

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are numerous examples of accidents involving tanker vessels that led to catastrophic results with long term repercussions. The *Exxon Valdez* disaster in Alaska - where the tanker ship run aground on a coastal shoal, in the year 1989 provides one example [2]. Several other disasters such as *Torrey Canyon* (1967) and *Amoco Cadiz* (1978), in addition to Exxon Valdez led to some of the regulatory changes in carriage and design regulations for ships in the maritime industry.

Contrary to popular belief, it is incorrect to conveniently assign the tag of "human error" as the main reason in these disasters. Various accident analyses have revealed the important role of organizational values in mitigating or contributing in such disasters [3]. In the maritime industry, the capsizing of the *Herald of Free Enterprise* in 1987 prompted the International Maritime Organization (IMO) to the establishment of International Safety Management (ISM) code which stipulated the formulation of Safety Management Systems (SMS) to achieve the organizational objectives [4]. In contemporary maritime operations, safety onboard ships should therefore be approached in a more holistic manner considering the role of managers executing decisions onshore, as well as the operators that are situated at the sharp end onboard. It is worth highlighting the factors which are critical in the context of organizational decisions that would lead to safe and reliable execution of operations as the end result.

The concept of Critical Success Factors (CSFs) has emerged from the domain of management sciences as key information managers must possess in organizations to execute critical decisions. Rockart [5, p. 4] defines Critical Success Factors as "*the few key areas of activity in which favorable results are absolutely necessary for a particular manager to reach his or her goals.*". When managing assets like tanker vessels, it is imperative that managers possess the information regarding critical areas such as operational characteristics, crew training level, machinery status etc., in form of indicators to proactively determine the decisions to be taken in liaison with the ship's crew in interest of continuous safe operations. It would be further interesting to investigate the relative importance given to different factors by the tanker vessel managers during day to day operations. CSF and the associated information when presented to the tanker vessel managers can constitute an important aid to quickly identify and address safety critical factors. The scope of this study is narrowed down to the determination of the CSF for the management of tanker vessels. In accordance with the above the following research question was developed: *What factors influence the success of safety management in tanker vessels?*

2 Method

To answer the research question, a search in Google Scholar© was conducted with the terms – "Maritime" and "Safety" as the key terms. The abstracts from first 20 pages with results were examined and articles addressing maritime safety and different causal factors having an impact on it were selected. This resulted in selection of the following articles – Heatherington et al. [6], Chauvin [7], Schroder-Hinrichs et al. [4], and Rothblum [8]. These documents along with some pre-selected literature that guided the formulation and interest towards initial research problem such as - Hsu et al. [9] and Håvold [10] pertaining to tanker vessels in particular and books like – *Managing maritime safety*

[11] and *Human factors in maritime domain* [12] were consulted thoroughly. Finally, *"the snowball technique"* as described by Ridley [13] was adopted by following up the references from the bibliographies of the literature consulted to examine all studies of relevance in connection to the research topic. The extracted literature was then reviewed to determine the various safety factors that reoccur in studies.

3 Results

In Heatherington et al. [6], 20 different studies undertaken in the context of maritime safety are analysed. The papers are categorized into three levels (often termed as the "onion" model) according to emergent factors – Design issues (automation), Personal issues (stress, shift work, fatigue, situational awareness, decision making, communication, team work etc.) and Organizational & Management issues (safety culture, safety climate and safety training). Schroder-Hinrichs et al. [4] aim to classify maritime incidents from maritime focused journals and documents submitted to IMO's Maritime Safety Committee (MSC) and utilize a similar taxonomy as Heatherington et al. [6]. However, their analysis adds one more layer termed "Environmental issues". Hsu et al. [9] identify four constructs such as Liveware (crew perceived safety and work attitudes), Hardware (condition of ship's machinery and equipment), Software (implementation of safety system and perceived safety climate) and Organization (safety policy and safety management) based on a literature review and operational features for product tankers.

Focusing on safety attitudes and culture onboard tanker vessels, and its impact on safety management, Håvold [10] conducted an exploratory factor analysis and found four predominant factors – management attitude towards safety, work content/pressure, knowledge and fatalism. Chauvin [7] proposes to examine the human role in maritime accidents at three levels – cognitive (individual) factors, interpersonal (social) factors and systemic or organizational factors. Similarly, Rothblum [8, p. 5] highlights the interplay of people, technology, environment, and organizational factors in the maritime operations. She states that "*Human errors are generally caused by technologies, environments, and organizations which are incompatible in some way with optimal human performance.*". In its essence, the reviewed literature implies that maritime accidents are never caused by a single factor, but that these are rather complex and multi-layered phenomena. A variety of approaches has been used in the identified literature to list the various factors. For the sake of the present study, the re-occurring factors have been grouped under six dimensions, namely:

(1) **Human factors** – The seafarers working on ships are the first line of defence in the safety system onboard and therefore maritime human factors have very special role to play in ensuring safe operations. Rothblum [8] mentions some of the individual factors such as knowledge and skills along with motivation and alertness which could influence the performance. Heatherington et al. [6] list factors such as fatigue, training, stress, communication, level of situation awareness and decision making etc. under the label of "Personal issues" and identify them as having an influence on the safety performance of individuals. Similarly, Hsu et al. [9] mention factors such as fatigue, crew safety knowledge, stress, perceived fatalism, physical and mental

health as having an impact on individual safety performance. Håvold [10] reports that the crew's knowledge regarding safety procedures and fatalism as some of the individual factors that impact on safety. Chauvin [7] draws attention to cognitive factors such as mental models and decision making that could in turn affect safety outcomes.

(2) **Technical factors** – Grech et al. [12] describe technical factors as ship equipment, tools, usability, and human-machine interaction issues onboard ships. The maritime industry has traditionally approached safety as technical issue which can be "fixed" by implementing various measures as can be evident in framing of regulations, for example SOLAS or MARPOL etc. Heatherington et al. [6] highlight design issues such as automation having an impact on safety onboard the ships if not utilized optimally. Similarly, Rothblum [8] lists "Poor design of automation" as a causal factor in maritime casualties. Hsu et al. [9] mention technical factors such as condition of ships, its machinery, and personal protective equipment as "Hardware".

(3) **Organizational factors** – Hsu et al. [9] define organizational factors as the safety policy and management systems for ships. They elaborate on these factors as the staffing level, the safety procedure documents, performance assessment and reward systems. Chauvin [7] states that the organization's safety culture is a factor at the systemic level influencing safety outcomes. Rothblum [8] identifies the crew size, hierarchical systems, training decisions and policies as the organizational factors. Heatherington et al. [6] list safety culture, safety climate and safety training as organizational factors having a direct influence on safety outcomes. Håvold [10] highlights factors such as management's attitude towards safety and the work content/pressure as influencing safety performance.

(4) **Environmental factors** – Rothblum [8] lists environmental factors such as physical working conditions as well as weather conditions as having an impact on safety performance. She also associates regulatory and economic conditions to the umbrella of the environmental factors. Hsu et al. [9] mention as weather conditions and location of ship (near berth or offshore) as environmental factors that are evident in maritime disasters. Grech et al. [12] state that there are numerous factors in the physical work environment that can adversely affect crew performance such as: noise, vibration, lighting, climatic conditions and accommodation standards.

(5) **Regulatory factors** – Tanker vessels are subjected to a more rigorous set of rules and regulations in their design and operations than other ships because of their special volatile nature. In addition to SOLAS regulations, tanker vessels are subjected to relevant MARPOL regulations and International Safety Management (ISM) Code. For chemical and gas carriers, there is the International Code for the Construction and Equipment of Ships Carrying Dangerous Chemicals in the Bulk (IBC code) and The International Code of the Construction and Equipment of Ships Carrying Liquefied Gases in Bulk (IGC code). For conventional oil tanker operations, the Oil Companies International Marine Forum (OCIMF) has published the International Safety Guide for Oil tankers and Terminals (ISGOTT) which is followed extensively. Schroder-Hinrichs et al. [4] name international standards, flag state regulations and port state regulations in their taxonomy as the regulatory environmental factors affecting maritime safety.

(6) **Economic factors** – There has been an ongoing debate around issues regarding Profit vs Safety related to socio-technical systems. In the reviewed literature, Rothblum [8, p. 5] draws attention to the fact that the economic factors can also affect the safety outcomes for ships, stating that – *"Tight economic conditions can increase the probability of risk taking (e.g. making schedule at all costs)*". Schroder-Hinrichs et al. [4] list the financial situation of the owner and the market situation as the economic environmental factors affecting safety onboard.

These factors can further be assigned classification in accordance with and as argued by Bullen and Rockart [14] in terms of them being Internal or External CSFs, as summarized Table 1 below:

Table 1. CSFs and subfactors affecting safety performance onboard tanker vessels

	CSFs	Sub-factors	Literature source
Internal CSFs	Human factors	• Crew's safety related knowledge • Crew's training and formal competence • Training in Non-technical skills such as – Leadership, Situation Awareness and Decision-making	Chauvin [7] Heatherington et al. [6] Håvold [10] Rothblum [8]
	Technical factors	• Condition of ship's machinery • Condition of PPE • Design of human machine interfaces (usability, standardization etc.)	Hsu et al. [9] Grech et al. [12] Heatherington et al. [6] Rothblum [8]
	Organizational factors	• Crew size and hierarchical system (power distance) • Organizational safety culture • Working conditions and work pressure (deadlines)	Håvold [10] Chauvin [7] Heatherington et al. [6]
External CSFs	Environmental factors	• Ships physical environment (Noise, vibrations) • Weather conditions (Heat, rain, cold)	Grech et al. [12] Hsu et al. [9] Rothblum [8]
	Regulatory factors	• International standards • Flag state and port state regulations	Schroder-Hinrichs et al. [4]
	Economic factors	• Financial situation of the ship owners • Market conditions	Schroder-Hinrichs et al. [4] Rothblum [8]

4 Discussion

It is worth noting that a generic division was made for the CSFs to be either internal or external. The human, organizational and technical factors were classified as internal whereas the regulatory, environmental and economic factors were classified as external. By their very definition, internal factors are the ones which are more within the manager's sphere of influence, whereas the external factors are the ones for which the managers have very limited capacity to influence. It should be however possible to identify/mitigate risks even for the factors not directly under control. Some of the factors, conventionally, have more tangible indicators than others. It is generally possible

for the managers to monitor the crew's competence levels, safety related knowledge, condition of ships machinery & its maintenance records. However, factors like poor design issues, attitude towards safety etc. are more difficult to quantify. When integrated with the management information systems, CSFs can provide valuable insight into the individual ship risk profile and corresponding management strategy. The focus of this preliminary investigation was mainly towards the determination of CSFs associated with tanker vessel management. With more comprehensive review of literature in next studies, and additional data collection, the results can also provide input towards the safety management of other types of vessels in general. It should also be noted that the above list of derived factors is not exhaustive. Further research can be used to determine more specific list of factors as well factors specific to intra-organization levels as well. Moving forward, the researchers aim to utilize multi-criteria decision-making techniques such as - Analytic Hierarchical Process (AHP) to obtain the relative importance as perceived by a selected number of representative samples from Health, Safety and Environment (HSE) managers from tanker shipping companies.

5 Conclusion

The present study aimed to review the literature associated with maritime safety and investigate Critical Success Factors that influence the safe operations of tanker vessels. The derived factors were grouped under six reoccurring categories basis their role in operational management of tanker vessels. Further research into CSFs and their perceived relative importance by the managers utilizing process like AHP can provide adequate evidence and guide the future research directions for optimal information system support for tanker vessel management.

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References

1. International Chamber of Shipping. https://www.ics-shipping.org/shipping-facts/shipping-facts
2. Piatt, J.F., Lensink, C.J., Butler, W., Kendziorek, M., Nysewander, D.R.: Immediate impact of the 'Exxon Valdez' oil spill on marine birds. Auk **107**(2), 387–397 (1990)
3. Oltedal, H., Wadsworth, E.: Risk perception in the Norwegian shipping industry and identification of influencing factors. Marit. Policy Manag. **37**(6), 601–623 (2010)
4. Schröder-Hinrichs, J.U., Hollnagel, E., Baldauf, M., Hofmann, S., Kataria, A.: Maritime human factors and IMO policy. Marit. Policy Manag. **40**(3), 243–260 (2013)
5. Rockart, J.F.: Current uses of the critical success factors process. In: Proceedings of the Fourteenth Annual Conference of the Society for Information Management, pp. 17–21 (1982)
6. Hetherington, C., Flin, R., Mearns, K.: Safety in shipping: the human element. J. Saf. Res. **37**(4), 401–411 (2006)
7. Chauvin, C.: Human factors and maritime safety. J. Navig. **64**(4), 625–632 (2011)

8. Rothblum, A.M.: Human error and marine safety. In: National Safety Council Congress and Expo, Orlando, FL, pp. 1–8 (2000)
9. Hsu, W.K.K., Huang, S.H.S., Yeh, R.F.J.: An assessment model of safety factors for product tankers in coastal shipping. Saf. Sci. **76**, 74–81 (2015)
10. Håvold, J.I.: Safety culture and safety management aboard tankers. Reliab. Eng. Syst. Saf. **95**(5), 511–519 (2010)
11. Oltedal, H.A., Lützhöft, M. (eds.): Managing Maritime Safety. Routledge, London (2018)
12. Grech, M., Horberry, T., Koester, T.: Human Factors in the Maritime Domain. CRC Press, London (2008)
13. Ridley, D.: The Literature Review: A Step-by-Step Guide for Students. Sage, London (2012)
14. Bullen, C., Rockart, J.F.: A primer on critical success factors, no. 69, pp. 1–75. Center for Information Systems Research. Massachusetts Institute of technology (1981)

Ergonomics Management Model with a Focus on Resilience Engineering

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Abstract. Companies have invested in implementing Ergonomic Programs aiming to reduce work related ergonomic risks and diseases and consequently, reduce sick leave costs and indemnities in labor suits. However, it should also be noted that these efforts are focused on reactive measures. In this way, the programs become vulnerable and inconsistent. The purpose of this article is to propose a Ergonomic Management Model based on applying principles of Resilience Engineering. It has been applied in a consumer goods industry in Brazil with 6000 employees, creating ergonomic processes and establishing actions to guarantee the program sustainability based on the concepts of Resilience Engineering. As a result, the practice of anticipating ergonomic risks on all fronts of ergonomics was the main benefit, generating as a socioeconomic impact the promotion of workers' health, reduction of absences from work and guaranteeing a sustainable ergonomic program.

Keywords: Resilience engineering · Ergonomics management · Ergonomic · Processes · Culture of prevention

1 Introduction

It is not possible to talk about work without mentioning work-related illnesses. These have been costly and affect not only the inflicted people themselves, but also their employers and society [1]. There is also a negative effect on companies due to sick leave, and incapacities to work have a direct impact on social, economic, both organizational and public health aspects [2]. Occupational diseases are responsible for a large part of lost workdays, and these costs are difficult to measure, considering costs directly related to treatment, as well as indirect costs such as lost productivity, taxes, compensation, new hires, training and qualifications for substitute workers [3]. It is not possible to talk about work without mentioning work-related illnesses. These have been costly and affect not only the inflicted people themselves, but also their employers and society [1]. There is also a negative effect on companies due to sick leave and the incapacity to work has a direct impact on socially, economically, both organizational and public health aspects [2]. Occupational diseases are responsible for a large part of lost workdays and these

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expenses are difficult to measure, be it directly related to treatment, or indirectly related, such as lost productivity, taxes, compensation, new hires, training and qualifications for substitute workers [3].

In fact, the lack of ergonomic specialists in these companies along with the lack of structure and lastly inefficient programs that focuses only on reactive spots make ergonomics program vulnerable and prone to failure. Better than having a successful program is preventing it from failing [4].

This article proposes an Ergonomics Management model with a focus on Resilience Engineering, developed and applied in a consumer goods industry in Brazil with 6000 employees, demonstrating every step for the Ergonomics Program implementation along with the necessary actions for applying the Resilience Engineering principles making the program possible, robust and sustainable.

The research presented in this article contributes to scientific knowledge from the development and implementation of a new management model in ergonomics with a proactive approach by applying the concepts of resilience engineering as well as how to position the ergonomics in a strategic way for businesses in addition to contributing to the reduction of disease costs, medical treatments and the amount of sick leave. Consequently, there is a social impact as people remain active, healthy and generating income.

2 Theoretical Framework

Ergonomics can contribute so much to improve working conditions. For companies, this can vary depending on the stage in which they occur [5]. Therefore, it is important to understand the different processes and their management.

The process is a structure for action with a beginning and an end. Starting from the initiation of a job in which activities have a specific definition regarding time and space [6]. Process management contributes to the organization to achieve the objectives of essential business processes through improvements in performance management and governance [7]. A model that sums up the concepts of the life cycle of businesses and process management with a purpose of continuous improvement consists of 6 phases: 1. Strategy development: Importance of identifying existing processes and offering an overview of the process models as well as collaborative processes. 2. Definition and modelling: Business process models are complex as are their definition and original model concepts must be managed. 3. Implementation: From the processes definition and modelling quality must be ensured therefore, it is important to analyse whether the model describes what was intended; whether it is understandable, consistent, and whether it is in accordance with reality. 4. Execution: For execution to be possible, the components interoperability work flow must be ensured. 5. Monitoring and control: It is possible to collect relevant information from the process as well as anomalies during its execution and thus more effectively identify and control. 6. Optimization and improvement: Measuring business processes performance forms the basis for improvements development and new process structures [8].

Ergonomics must be present from the very beginning to ensure that the work environment is adequate to the psychophysiological characteristics of workers. And that

it is applied in different situations with different approaches. Also, there are specific approaches consisting mainly of 4 lines of action comprised of design ergonomics, correction ergonomics, awareness ergonomics and participation ergonomics [5]. There is a huge opportunity for improvement when carefully analysing projects, solutions and production strategies and if the principles of ergonomics are incorporated [9]. The Occupational Safety Health Administration characterizes an ergonomics program as having 4 main elements: A. workplace analysis; B. risk prevention and control; C. medical treatment management; D. training and education [10].

Actions arising from this application model also present both reactive and proactive demands. Companies that invest in prevention through ergonomic actions with a proactive approach have reduced sick leave costs, treating employees with work-related illnesses, reduced the need to replace workers, new training, and in addition proportionate benefits to people, gains in productivity and in its quality as well [11].

Resilience is an ability that can be found at the individual level as well as at the systemic or organizational level. A resilient system is able to quickly address disturbances and monitor anticipated risks [12]. Few organizations critically look out for potential risks after a long period of stability. Resilience engineering goes further, as it seeks to improve organizations performance under different conditions and develops the expertise to anticipate undesirable events [13]. Resilience engineering can positively contribute to the evolution of Health and Safety at Work in organizations, salvaging previous knowledge, problematizing the subject and seeking reflections to eliminate or reduce the risk factors that may cause accidents and work incidents involving every component of the system [14].

In order to measure the actions completion resilience engineering strategies must be applied which are: Failure Minimization; Early Detection; Flexibility; Controllability; Effects Limitation; Administrative Controls and Procedures [15]. The model presented by the same author proposes that a resilient organization must convey 4 main skills: 1. Ability to Respond: A resilient organization must know what to do and when to do it. This ability deals with reality. 2. Ability to Monitor: A resilient organization must be able to flexibly monitor what occurs for long-term survival. It must be able to monitor its own performance, opportunities and potential threats before they become real. This is the ability to deal with criticism. 3. Ability to Anticipate: A resilient organization must be able to anticipate future events, which are beyond current operational events and their variability. This is the ability to deal with potential. 4. Ability to Learn: A resilient organization must be able to learn from experience, by understanding events. This is the ability to deal with the factual [13].

3 Methodology

For the structure's construction and stage definitions of management model in ergonomics implementation, the life cycle model of a business process has been adapted, where each relevant step and actions are demonstrated [8]. In this construction, performance areas of ergonomics have been considered as well as the application of resilience engineering principles based on the model of ergonomics program proposed by the Occupational Safety Health Administration and adapted in this study [5, 10, 13]. This

structure is divided into 6 stages as follows: 1. Strategy Development: Made knowing the company's demand; Definition of Human Resources; identification of the existing processes (overview) and understanding of Ergonomics as strategic for the business. 2. Definition and Modeling: The model to be implemented has been developed and the management model proposed. 3. Implementation: The inputs and outputs for each process were defined; step by step description of the implementation of each step; guaranteed application and interrelation between models in ergonomic processes. 4. Execution: Interoperability between the components of the workflow was ensured by complying with the procedures of each ergonomic process. 5. Monitoring and Control: Relevant process information was built; process indicators developed; anomalies or variability controls were performed. 6. Optimization and Improvement: Based on the performance measure, improvements and new ergonomic process structures were proposed. Ensure that the ergonomics program become robust and sustainable, resilience engineering strategies were applied with actions on the following fronts: Failure Minimization; Early Detection; Flexibility; Controllability; Effects Limitation; Administrative Controls and Procedures [15]. This model was applied in a consumer goods company in Brazil with 6000 employees from February 2013 to October 2018.

4 Results

The application of the model made it possible to characterize the management of ergonomics and its processes with the same structure as the management of processes and businesses, by defining inputs and outputs of each ergonomic process, responsible for the actions and constant search for continuous improvement from the critical analysis of the processes carried out regularly. In step 1, Strategy Development, a physiotherapist and ergonomist was hired who identified the demands aligned with the actions of the ergonomics program within the company's business strategy and structured a team with 11 ergonomic process controllers and 1 Occupational Therapist trained in ergonomics. The scenario presented at the time was a significant number of ergonomic complaints and many dismissals of workers with actions only with a reactive focus. In step 2, Definition and Modeling, the model created enabled proactive actions with an approach in several interface areas aimed at anticipating and dealing with potential ergonomic risks in compliance with the principles of resilience engineering. In step 3, Implementation, there was the definition of the related processes from each ergonomics front, details of the pertinent characteristics, objectives, processes developed, target audience, interface areas, as detailed in Table 1.

In step 4, Execution, the ergonomic requirements proposed in each process were met and interoperability between the different areas within the company was guaranteed (areas related to worker health, areas that ensure compliance with legislation, areas of development and execution of projects, financial and managerial areas), through the regular practice of the procedures defined for each ergonomic process according to the management model developed. In step 5, Monitoring and Control, it was found that the development of ergonomic processes allowed the creation of indicators that made it possible to measure demands, plan the physical structure, people and deadlines for meeting these early identifiable problems or potential risks, guidance for decision making in prioritizing improvements to be made.

Table 1. Ergonomics management focusing on principles of resilience engineering

Ergonomics action fronts	Demand (reactive/proactive)	Principle of resilience engineering applied	Actions
Correction ergonomics	Reactive	Answer Learn	Complaints management Ergonomic complaint evaluation Ergonomic workstation evaluation Intervention/Adequacy evaluation Improvement validation
	Proactive	Monitor Anticipate	Ergonomic mapping Prioritization for planning ergonomic assessments Prioritizing projects Adequacy of posts Improvement validation
Conceiving ergonomics	Proactive	Anticipate Learn	Participation of ergonomics in all stages of the project (from concept to implantation) Ensuring compliance with ergonomics principles by the project in execution Proposed changes in innovation based on a history of previous problems
Awareness ergonomics	Proactive	Anticipate Learn Monitor	Prevention Culture Promotion through training and capacity building for all the company hierarchical level Behavioral changes monitoring through audits and inspections, and the development and dissemination of indicators
Participation ergonomics	Proactive	Anticipate Answer Learn	Actor insertion (collaborator) in the change process Internalization of the prevention culture

Among these, there are indicators to control the adequacy of jobs, control of registered complaints and informal complaints (identified in audits carried out by the ergonomics team), control of employee absences, and control for prioritizing investments in innovation projects, and, control of behavioral aspects in relation to the culture of prevention at all hierarchical levels of the organization. Finally, in the sixth step, Optimization and Improvement, the sustainability characteristics for the ergonomics program were developed through the application of resilience engineering strategies. For each of these strategies actions were designed to meet their objectives. This practice allowed a critical analysis of the ergonomics program itself considering its relevance,

performance, customer service, main deviations or variations found, delivery capacity, search for improvements and innovations.

Applying ergonomics management model generated several gains, notably the reduction in 61% of critical posts, through risks treatment and anticipation in conjunction with the areas of process and product engineering; 45% reduction in sick leave; total success with labor inspection agencies, which recognized the implementation of a robust and efficient ergonomics program sustainable; and the positioning of the ergonomics area as strategic for the business and for the promotion of the culture of prevention. The company also received external recognition, for the ergonomics program implemented, in awards that highlight the best practices in EHS (Environment, Health and Safety) at the national level.

5 Conclusion

The model proposed and presented in this article, which was applied in a consumer goods company proved that ergonomics when applied proactively is a strong allied to the organization's business strategies. The results showed that the practices developed by this model enabled to implement the culture of prevention, to promote health, to develop ergonomically adequate jobs and work processes, to reduce work-related diseases, to avoid costs, and to contribute to society, by reducing the number of absences from work.

References

1. Neumann, W.P., Ekman, M., Winkel, J.: Integrating ergonomics into production system development–the Volvo Powertrain case. Appl. Ergon. **40**(3), 527–537 (2009)
2. Jakobi, H.R., et al.: Inability to work: analysis of sickness benefits granted in the State of Rondônia. Ciência Saúde Coletiva **18**(11), 3157–3168 (2013)
3. Amell, T.K., Kumar, S., Rosser, B.W.J.: Ergonomics, loss management, and occupational injury and illness surveillance. Part 2: injury and illness incident profile. Sample data. Int. J. Ind. Ergon. **29**(4), 199–210 (2002)
4. Hollnagel, E.: From protection to resilience: changing views on how to achieve safety. In: Proceedings of the 8th International Symposium of the Australian Aviation Psychology Association (2008)
5. Iida, I., de Guimarães, L.B.M.: Ergonomia: Projeto e Produção, 3ª. ed. Edgard Blücher Ltda (2016)
6. Davenport, T.H.: Mission Critical: Realizing the Promise of Enterprise Systems. Harvard Business Press, Cambridge (2000)
7. Jeston, J., Nelis, J.: Business Process Management. Routledge, Abingdon (2014)
8. Houy, C., Fettke, P., Loos, P.: Empirical research in business process management-analysis of an emerging field of research. Bus. Process Manag. J. **16**(4), 619–661 (2010)
9. Falck, A.C., Rosenqvist, M.: What are the obstacles and needs of proactive ergonomics measures at early product development stages? – An interview study in five Swedish companies. Int. J. Ind. Ergon. **42**(5), 406–415 (2012)
10. Occupational Safety and Health Administration et al.: Ergonomics program management guidelines for meatpacking plants. Department of Labor, Washington (DC) (1990). https://www.osha.gov/Publications/OSHA3123/3123.html. Acesso em: 16 Apr 2018

11. De Looze, M.P., et al.: Cost effectiveness of ergonomic interventions in production. Hum. Factors Ergon. Manuf. Serv. Ind. **20**(4), 316–323 (2010)
12. Martínez, R.M.: Ingeniería de la resiliencia: nueva tendencia en la gestión de la seguridad laboral. Seguridad y Salud en el Trabajo, n **63**, 13–19 (2011)
13. Hollnagel, E.: How resilient is your organisation? An introduction to the Resilience Analysis Grid (RAG). In: Sustainable Transformation: Building a Resilient Organization (2010)
14. Machado, M.S.M., Sremin, M., Batiz, E.C.: Revisão da literatura sobre o papel da Engenharia da Resiliência na Saúde e Segurança do Trabalho. Revista Produção em Foco **03**(01), 120–143 (2013)
15. Dinh, L.T., et al.: Resilience engineering of industrial processes: principles and contributing factors. J. Loss Prev. Process Ind. **25**(2), 233–241 (2012)

Organizational Commitment

Leadership in Ensuring Positive Socio-Psychological Experiences of Employees

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Abstract. Competitive environment along with the "24/7 Society" characterized by a perfectionist approach to work have become a real challenge for contemporary employees. They must frequently maintain a high working tempo, carry the workload, take increasingly more responsibilities, and face constant changes. Consequently, employees may feel threatened – either psychologically or socially. Leaders have a crucial role in this stressful working environment. They could both predict and reduce the feeling of vulnerability of employees and boost their self-confidence. Leaders could inspire employees, or conversely, make them feel unhappy or unsatisfied. Hence, leaders affect the socio-psychological experiences of the employees. Appropriate behaviors of leaders can ensure sustainable positive socio-psychological experiences; however, negative inappropriate behaviors can be treated as working environment threats and stressors. The aim of the paper is to reveal the critical leadership behavior-based threats and rewards that shape the socio-psychological experience of employees thus suggesting how leaders could ensure positive socio-psychological experiences for employees.

Keywords: Leadership · Employees · Socio-psychological experiences

1 Introduction

According to the European Agency for Safety and Health at Work, 28% of employees have health problems due to work-related stress [10]. On the one hand, the growing demands of the working environment, and on the other hand, personal ambitions create an ambiguous situation that could be described as the "Harm/Benefit Paradox" [15]. The statement that "work can be harmful" [15] implies a situation without a way out, but it is precisely this situation that requires new insights. Moreover, the scientific literature identifies a perplexing situation in which human resources are recognized as key sources of organizational success [6]; however organizations do not pay sufficient attention to the application of sustainable human management practices [16] that would ensure positive socio-psychological experiences of employees. Recently, Job Demands–Resources Theory has been rethought with emphasis on several unresolved issues [2]. According to authors, leaders may also influence the working environment of employees [2, 3], and this

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way leaders may have an indirect impact on performance at work due to positive socio-psychological experiences of employees. The critical role of the leaders is also confirmed by other scholars [4, 7, 28]. Leadership can be described as an ability "to Listen with Enthusiasm, having an Aspiring mind to be able to make a Decisive action, Empower and Encourage others in a Responsible, Supportive and Humble manner by Inspiring the team to achieve set goals as Planned" (LEADERSHIP) [26]. Although leadership has always been a field of multidisciplinary research, it has often been studied only as a social phenomenon. The last decade has seen the emerging field of neuroleadership [20–24] that is focused on bringing "hard science" to the social science field of leadership [20]. The term neuroleadership was introduced by David Rock [21]. Based on neuroscience, research in neuroleadership develops new approaches to people management by measuring and analyzing the physical processes in the brain that are stimulated by different working environment factors including human interaction [8, 13, 27].

The paper contributes to the knowledge about leadership exploring the behaviors of leaders that can ensure positive socio-psychological experiences, or conversely, create threats and suppose negative socio-psychological experiences using the SCARF neuroleadership model developed David Rock [21].

2 Theoretical Background

The integration of psychology and neuroscience knowledge provides a better understanding of both human nature and behavioral motives, while at the same time encouraging leadership behaviors that ensure positive socio-psychological experiences. The SCARF model developed by David Rock is closely related to Broaden and Build Theory, which states that the safer and happier people feel, the better their performance is [11], and Motivation and Hygiene Factor Theory, Progress Theory, and the Three-Factor Theory that help to understand the factors in the working environment that make people unhappy or, on the contrary – make them feel encouraged and satisfied [1, 25].

The *SCARF model* is based on an assumption that the human brain responds to social threats and rewards in the same way as physiological threats or opportunities [9, 14]. According to the SCARF model, the five domains (Status, Certainty, Autonomy, Relatedness, and Fairness) of experience are strongly exposed to the threats and rewards in the working environment. Meanwhile, the importance of these domains may vary for different employees. Moreover, people are of different sensitivity and accept failures or successes differently. Consequently, a leader should understand the importance of each SCARF domain for different employees and create a working environment conducive to positive experiences.

Status can be associated with hierarchy as much as with social opinion or reputation. It can be described as a subjective feeling; however, status is more reliant on the evaluations of others [18]; however, one's own status affects the perception of the status of others [12]. People may use different strategies to attain a high status. The leader's job is to help the employees gain status while also ensuring their own status among the employees.

Certainty emphasizes the importance of knowing what will happen in the future. Uncertainty in the workplace results in unstable employee–employer relationships, which affect the employee's job performance and commitment towards the organization [5]. However, ensuring certainty in uncertain times is a leader's task, the success

of which will primarily depend on the leader's ability to inform and communicate with employees.

Autonomy at work and work outcomes such as job performance is a widely studied phenomenon [2, 3]. According to scientists', autonomy becomes particularly important when the job demands are very high [3]. Meanwhile, the level of autonomy is highly dependent on the employee's competency and psychological maturity and the leader needs to assess the employee's desired degree of autonomy.

Relatedness refers to the belonging to a social group, knowing who a friend or foe is [23]. Due to the assumption that relationship comes before the result [19], it is very important for the leader to build and maintain effective interpersonal relationships. A leader who is caring and friendly towards employees is more likely to win their friendship and loyalty [26] and to earn their trust and engagement [1].

Fairness is a perception of fair exchanges between people and is especially crucial for leaders. Providing equal opportunities for all employees and acting in alignment with organizational values, leaders enable positive socio-psychological experiences of employees. Meanwhile, biases and favoritism suppose ethical ambiguity [17].

Despite the widespread acceptance of this model, some authors note that the neuroleadership findings should not be adopted with blind optimism [13]. Neuroscience allows for objective identification of critical factors, primarily by eliminating subjective perceptions and assessing stress [7]. For the purpose of revealing the nature of causation, we should turn to traditional qualitative research methods that enable the understanding of the phenomenon in the context of working environment.

3 Methodology

A qualitative research method was applied for this research. In doing this, the qualitative data were collected from Lithuanian organizations using semi-structured interviews with 69 employees. The research instrument was developed using the SCARF model of Rock [23]. In order to understand the phenomenon of leadership, respondents were asked to tell how important the SCARF domains were to them and to recall the most memorable leadership behaviors that made the respondents [R] feel threatened or encouraged in each of the SCARF domains. The interviews lasted from 40 min to 1 h and 35 min. The study included 25 (36.23%) males and 44 (63.77%) females. Of these, 57.38% were in managerial positions. The majority of respondents were from the service (41%) and manufacturing (38%) sectors. Thirty-one per cent of the respondents represented large organizations with more than 500 employees.

4 Empirical Findings

Qualitative research has revealed the leadership behaviors that form positive and negative socio-psychological experiences of employees. Due to the limited scope of the article, the research results are presented in brief providing only the key points.

Status. Respondents stressed the importance of being recognized as competent specialists ("Respect and trust of the team leader is important to me…" [R2], "Look what you

think? – and together with manager we are looking for a common solution. I feel that the manager appreciates me and trusts me." [R8]). In emphasizing positive experiences, respondents particularly noted the importance of praise [R23], [R37], [R64], [R67] etc., recognition of professionalism [R4], [R18] etc. and recognition of results [R36], [R55] etc. Negative experiences were related to disrespectful or unequal behavior [R35], [R44] etc., and to the fear to disappoint the leader by failing to achieve professional goals, which, in their opinion, could lead them to lose their status ("… you do not want to fall into the mud, losing your status completely" [R19]). Thus, the study revealed that it is very important for the leaders to treat the employee as an equal partner and to recognize the employee's performance and personal professionalism when caring for the employees' status.

Certainty. Respondents mentioned that certainty at work was associated with good wages, stable company position in the market, clear vision of the organization, and confidence in the leader. Respondents perceived the certainty twofold. First, it is certainty in employability. "The confidence probably comes when you know that the manager respects and supports you. Yes, mutual respect at work is very important to me. This gives a sense of certainty" [R5]. "My immediate supervisor appreciates me, and although I am not always able to achieve the goals…. I feel stronger when I know that in the eyes of shareholders my direct supervisor will protect me. Well, at least it seems so to me…" [R24]). Second, it is related to decision-making in the context of uncertainty, limited information and rapid change. ("You can feel assured when you know your job well, when you know that team leader trusts you and you are confident in yourself" [R3]). Respondents placed great emphasis on trust in the leader. The manager's phrase: "I never lie, I just don't always tell the whole truth" [R61] makes wonder if this kind of leadership behavior leads to positive experiences for the employee. Confidence in the leader is weakened when they constantly change their opinion or position on something [R25] or do not provide information [R26], [R40] etc. Many respondents mentioned the fear of losing their job due to the economic situation [R1], [R3], [R28], and certainty were associated with the clarity of prospects of strategic development of the company ("Personal statement by the manager that the company will continue its business and is not moving to a less expensive country" [R2]), technology deployment ("…I may be replaced by new technologies and my services as a human being will not be needed" [R49]) or changes in general ("… all changes bring anxiety. Whether those changes are good or bad, they must be accepted as a gift. Every morning the sun comes up… I understand what my strengths are and what I can do differently to survive in these situations." [R12]). In all these cases, an emphasis was placed on informing the employees and the way it was done.

Autonomy. In defining autonomy, almost all respondents emphasized autonomous decision-making within the scope of personal responsibilities and competences ("freedom to make decisions within their own field of competence" [R39], "…to work independently, to make decisions without comments of manager on each step" [R6]). However, they also emphasized teleworking [R2], time scheduling ("… you may not be at work, most important are the results you show at the end of the month" [R11]). Autonomy is undoubtedly linked to the confidence in the employee ("When the CEO leaves for

period X (business trips, vacations), I substitute the director… this reinforces the sense of autonomy" [R17].

The study also revealed a very interesting situation regarding the implementation of modern forms of work organization, which sometimes lead to the opposite results than expected. According to one respondent, "LEAN has reduced the autonomy in principle because you enter a structure, you are hit by a frame. And the new manager comes very often to ask me about the success, priorities, tasks… every hour… it means couching. You lose the sense of being able to make the decisions because he tells everything, points it out… Oh, it is said… LEAN strengthens the autonomy…" [R25].

Respondents also asserted the importance of clarity of the role emphasizing the rights and responsibilities that define the subject's autonomy.

Relations. The majority of respondents pointed out trust as a cornerstone of good relationships. Alongside this, not being afraid to ask for help or support [R5], lack of talk [R1, R37], and necessity of openness [R13] were mentioned. This notwithstanding, good relationships should not be idealized, and the organizational climate is good, as one respondent noted when "…you can quarrel with each other and it takes about five minutes, then everything is back to old" [R40]).

Respondents also highlighted the importance of leaders' support. "I… do not receive any support…. I was disappointed…. Somehow, I'm lacking support,… or a good word. Only when something is done, then maybe he (manager) will say something" [R47]. A good relationship can be achieved when the organization has a clear, accurate distribution of duties and responsibilities, and all the members of the organization are strategically oriented towards strategic goals. Then the organization can have good relationships based on the same shared values, mutual understanding, support, friendliness, empathy etc. Respondents also highlighted the importance of leadership support and the key role of leaders in team building and development.

Fairness. Respondents associated fairness with objective outcome-based evaluation [R1], [R22], [R61] etc., equality [R9], [R22] etc., eliminating sympathy/antipathy [R16], [R43] etc., and emphasis on value-based leadership decisions [R19], [R53], etc. According to the respondents "Fairness is the value of the company, the basis of its activities" [R25]; "Fairness is the knowing that more and less everyone in the organization follows more and less the same rules" [R69]. Fairness becomes a critical factor in changes, because only a transparent and open relationship between the leader and employee reduces the resistance to change. Moreover, positive socio-psychological experiences are driven by open and transparent communication of the leaders with employees and honest behavior, because "when employers fail to see good deeds and emphasize the things that are bad, you swallow the pill and keep working" [R42].

5 Conclusions

The research disclosed crucial behaviors of leaders that affect the five domains of the socio-psychological experiences. The study revealed that it is important for the leaders

to recognize the employees' performance and personal professionalism when caring for the employees' status.

The respondents associated certainty primarily with the level of confidence in the leader. Emphasis was placed on informing the employees and the way it was done. In defining autonomy, respondents emphasized autonomous decision-making within the framework of personal responsibilities and competencies. Respondents also asserted the importance of clarity of the role, emphasizing the rights and responsibilities that define the subject's autonomy. The majority of respondents pointed out trust as a cornerstone of good relationships. They also highlighted the importance of leadership support and the key role of leaders in team building and development. The respondents associated fairness with objective outcome-based evaluation, eliminating sympathy/antipathy, and emphasis on value-based leadership decisions.

In addition, the study identified that all five domains of socio-psychological experiences were highly influenced by change. Changes are generally seen as a threat to status and uncertainty, they reduce or increase the degree of autonomy, bring confusion to relationships due to the rethinking of the roles between the employees, and make employees sensitive to the sense of fairness. In this context, it is particularly important for leaders to behave in ways that support the staff morally, provide them with full information about the process of change and prospects, recognize their contribution, and provide organizational support to develop the necessary skills and competences.

References

1. Amabile, T., Kramer, S.: The Progress Principle – Using Small Wins to Ignite Joy, Engagement and Creativity at Work. Harvard Business Review Press, Boston (2011)
2. Bakker, A.B., Demerouti, E.: Job demands-resources theory: taking stock and looking forward. J. Occup. Health Psychol. **22**(3), 273–285 (2017)
3. Bakker, A.B., Demerouti, E.: Multiple levels in job demands-resources theory: implications for employee well-being and performance. In: Diener, E., Oishi, S., Tay, L. (eds.) Handbook of wellbeing. DEF Publishers, Salt Lake City (2018)
4. Berger, R., Czakert, J.P., Leuteritz, J.P., Leiva, D.: How and when do leaders influence employees' well-being? Mod. Mediation Models Job Demands Resour. **10**, 1–15 (2019)
5. Bussin, M., Christos, D., Bergh, V.: What would Organisational Design Look like in Uber Times? HR Future, August 2017, pp. 36–38 (2017)
6. De Prins, P., De Vos, A., Van Beirendonck, L., Segers, J.: Sustainable HRM for sustainable careers: introducing the 'respect openness continuity (ROC)' Model. In: De Vos, A., Van der Heijden, B. (eds.) Handbook of Research on Sustainable Careers 2015, pp. 319–334. Edward Elgar Publishing, Cheltenham (2015)
7. Diebig, M.: Leadership and work stress: a three study investigation on stress-related antecedents and consequences of full-range leadership behaviors, Dissertation. TU Dortmund University (2016)
8. Donde, R., Williams, C.: Mapping leadership behaviors to NeuroLeadership models: a NASA case study. NeuroLeadersh. J. **4**, 1–23 (2012)
9. Eisenberger, N.I., Lieberman, M.D., Williams, K.D.: Does rejection hurt? An fMRI study of social exclusion. Science **302**, 290–292 (2003)
10. European Agency for Safety and Health at Work. https://osha.europa.eu/en/publications/factsheet-22-work-related-stress/view

11. Fredrickson, B.L.: The broaden-and-build theory of positive emotions. Phil. Trans. R. Soc. Lond. B. **359**, 1367–1377 (2004)
12. Koski, J.E., Xie, H., Olson, I.R.: Understanding social hierarchies: the neural and psychological foundations of status perception. Soc. Neurosci. **10**(5), 527–550 (2015)
13. Kuhlmann, N., Kadgien, Ch.A.: Neuroleadership: themes and limitations of an emerging interdisciplinary field. In: Healthcare Management Forum, vol. 31, pp. 103–107 (2018)
14. Lieberman, M.D., Eisenberger, N.I.: Pains and pleasures of social life. Science **323**, 890–891 (2009)
15. Litchfield, P., Cooper, C., Hancock, C., Watt, P.: Work and wellbeing in the 21st century. Int. J. Environ. Res. Pub. Health **13**(11), 1065 (2016)
16. Mariappanadar, S., Aust, I.: The dark side of overwork: an empirical evidence of social harm of work from a sustainable HRM perspective. Int. Stud. Manag. Organ. **47**(4), 372–387 (2017)
17. Palermo, O.A., Carnaz, A.C., Duarte, H.: Favouritism: exploring the 'uncontrolled' spaces of the leadership experience. Leadership **15**(3), 381–397 (2019)
18. Perry, J.L.: Power and status in groups, Dissertation. The State University of New Jersey. Newark, New Jersey (2014)
19. Price, D.: Well said!: presentations and conversations that get results. AMACOM (2012)
20. Ringleb, Al.H., Rock, D., Ancona, Ch.: Neuroleadership in 2014. NeuroLeadership J. **5**, 1–27 (2015)
21. Rock, D.: SCARF: a brain-based model for collaborating with and influencing others. NeuroLeadership J. **1**, 44–52 (2008)
22. Rock, D.: Your Brain at Work. HarperCollins, pp. 29–101, New York (2009)
23. Rock, D., Cox, Ch.: SCARF® in 2012: updating the social neuroscience of collaborating with others. NeuroLeadersh. J. **4**, 1–6 (2012)
24. Rock, D., Davis, J., Jones, B.: Kill your performance ratings. Neuroscience shows why numbers-based HR management is obsolete. Strategy + business. **76**, 1–19 (2014)
25. Sirota, D., Klein, D.: Enthusiastic Employee, The: How Companies Profit by Giving Workers What They Want, 2nd edn. (2013)
26. Surji, K.M.: Understanding leadership and factors that influence leaders' effectiveness. Eur. J. Bus. Manag. **7**(33), 154–167 (2015)
27. Waytz, A., Mason, M.: Your Brain at Work. Harvard Business Review, Cambridge (2013)
28. Zwaan, L.A., Viljoen, R., Aiken, D.: The role of NeuroLeadership in work engagement. SA J. Hum. Resour. Manag./SA Tydskrif vir Menslikehulpbronbestuur **17**, 1172 (2019)

Retaining Steel Tips: Motivation of Construction Managers in South Africa

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Abstract. The world economy continues to grow at an ever-increasing pace and as a result, has created additional demand for new buildings. This has placed an ever-increasing demand for experienced construction managers with learned and practically applied skills to competently deliver successful projects. South Africa is no exception to this phenomenon. To retain skilled construction managers projects must be well managed from the outset. Having the correct policies and procedures in place will assist with this requirement. Motivating factors play a large role to assist construction managers in achieving their best and keeping their focus. Thus, how to motivate them is key to ensuring that a project delivers on; quality, time and within budget. This paper attempts to identify factors that motivate construction managers and assist construction companies to retain them. For this purpose, structured interviews were conducted at the University of Pretoria and a mixed-method approach was followed. Data was collected from construction professionals with a minimum of 10 years of construction site experience within the Gauteng Region of South Africa. The decisive factor was the work environment conditions and this included factors like; creating job security, give employees a sense of belonging, mentors giving constructive criticism, listening to problems, acting on them and thus giving support, reducing long working hours, improved site office facilities, regular relaxing social events within the company. Results from a recent research project have identified three items that are needed to retain construction managers. These included; a good work environment and extrinsic and intrinsic rewards. It was found not uncommon that if an offer to be employed at an alternative company with less salary, but with a more comfortable work environment was available, then this would be a viable option. Construction companies should invest more effort to improve their work environment and further tailor-make their extrinsic and intrinsic awards systems.

Keywords: Construction manager · Motivation · Well-being · Gauteng · South Africa

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1 Introduction

Attracting and retaining skilled construction managers is a current problem that faces the construction industry [1]. The perception and in reality is that the construction industry needs improvement. Some of these areas of concern include; poor health and safety, competitive annual income packages, well-being, work stability, the image of the industry, productivity and females in construction. Addressing these will ultimately come from improvements in technology, processes, upskilling of construction managers and a different way of approaching the motivating environment on construction sites [2–4].

The construction manager, the stalwart of a team, who is charged with the responsibility of leadership throughout a project's delivery will ultimately be a crucial team member that ensures its success [1]. Clients of modern construction projects can be arduous when their expectations regarding key performance indicators of, time, cost and quality are not met. To temper this and provide better project outcomes, requires skilled construction managers.

The South African construction industry continues to experience both internal and external issues that directly influence the psychological and physical performance of constructions managers. Some of these can affect their motivation levels and their behaviour in the workplace. These include; absenteeism, grievances, alcohol and drug abuse, accidents, conflicts, commitment issues, quality of work and high divorce rates. The multi-effect nature of this matter makes the remedy or management of these issues extremely complex. One approach may be for construction companies to move away from traditional approaches to motivate their construction managers. This is based on the premise that as individuals, each construction manager will be motivated in different ways.

2 Literature Review

The principle role and function of the Human Resource Management Department within a construction company is to know how construction managers perform as they do [5–7]. Some of the key issues and factors which could influence behavioural traits of construction managers are discussed in this section.

2.1 Motivation

Motivus is a Latin word from which the term motivation is derived as it best describes what events influence people's behavioural actions or plans. [7]. Motivation can be defined as "the willingness of individuals and teams to exert high levels of effort to attain organisational goals, conditioned by the efforts capability to satisfy individual and team needs" [8]. Motivation can also be defined as the "willingness to do something, and it is conditioned by this action's ability to satisfy some need of the individual" [9] or a "psychological process that arouses and directs goal-directed behavior" [5]. "Even when people have clear work objectives, the right skills and a supportive work environment, they must have sufficient motivation to achieve their work objectives" [10].

There is no communal ground on what are the most aspirational motivations required for construction mangers, even though research to date has shown several overlaying theories.

There are currently several theories with regard to what are the prime motivations for construction managers. Amongst these, there are various overlays, but still no communal ground between them. [10].

These can be divided into two main groups:

(1) Content theories (older) concentrate more on the factors, causing motivation; and
(2) Process theories (more modern), attempt to explain how motivation and behaviour narrate to each other. Modern process theories concentrate more on the association between elements that yield or prevent motivation and the needs and causes are the main focus in the older content theories [8].

So, motivation can still be seen as a very complex topic. There are many different expert explanations for and approaches to motivation. There is no one specific type that can be applied as situations will vary with regard to ingredients for an integrated model for creating a motivating climate [8].

What can be concluded, is that to create a motivating climate; process theories such as; expectancy, equity and goal-setting theories combined with the job-characteristic theories and some elements of the older content theories are important.

If a company fails to understand the importance of any one of the elements of aligning-commitment, they would be unsuccessful in their quest to provide motivation and would result in zero commitment. This is based according to the aligned-commitment formula that can be best expressed as:

Aligned-commitment = Knowledge × Information × Empowerment × Rewards & Recognition × Shared Vision [1, 8].

2.2 High-Performance Construction Teams

The construction industry needs high-performance teams to cope with the industry's demands. Three to five years are required to build high-performance teams [5]. It has been found that the following equation can be used to guarantee peak performance.

(peak performance = potential × commitment × motivating climate) [8].

For construction managers as a whole, performance measures should be put in place by the company that will produce positive reinforcement outcomes and linked to a team's performance [8].

Construction companies, in general, need to grasp the concept, that an annual increase in salary is welcomed by construction managers; but very few link these increases directly to the effort they have made [8].

Fair, meaningful and attainable recognition schemes and rewards are considered vital to ensure performance [1]. Construction managers will compare their rewards with other construction managers within the company, construction industry and other industries. According to the Equity Theory, whether the latter information received is correct or not, they will perceive it as the truth. The satisfaction or dissatisfaction that may sprout from this, may influence the effort and further indirectly link to causes that impact their performance.

If any of the elements are missing in the chain as shown in Fig. 1 below, it would have the result of leading to dissatisfaction. For this reason, it is very important for the construction company to have the ability to create a motivating climate for construction managers when difficult construction site conditions and project constraints present themselves. By successfully creating a motivating climate for individuals and teams on construction sites, their full potential would be unlocked i.e. construction workers are issued different coloured hats to differentiate them. Coloured hats can be used to visually celebrate rank based on acknowledged improvement in tasks and performance. This could be especially true for general labourers. Once they attain a certain colour, they may be able to progress and join a skilled team that wear one colour and even have a name for their trade. Fore example, steel fixers could all wear a red hard hat and have a name like 'The Scorpions' [1].

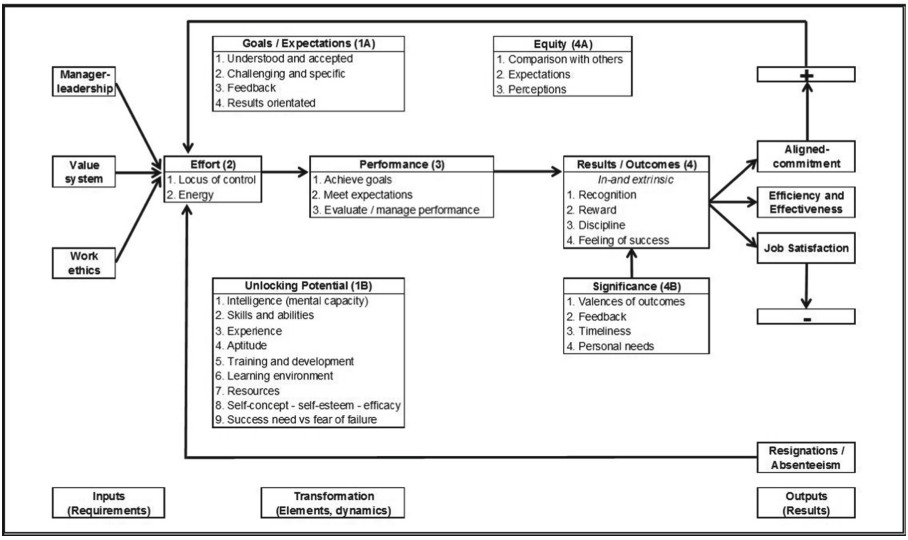

Fig. 1. Elements and dynamics of a motivating climate [8]

3 Research Method

A literature review was performed to identify the factors for retaining construction managers. A mixed-methods was applied, making use of a structured interview. The data was collected at the University of Pretoria. During the research, the participants that consisted of construction managers with 10 or more years' experience in construction site management and a B.Sc. degree in construction management were used. They were given the opportunity to provide relevant responses based on their own; experiences, insights, opinions, perspectives and attitudes towards the research topic. This included audio recordings to enable data analysis at a later stage. The target population was further refined to include different sectors of the South African built environment in the areas

of; residential, industrial, office/retail, civil engineering and roadworks. Different age groups were also singled out by the researchers to target responses. It was hypothesised that age may influence different value propositions. Ethical clearance for this research study was approved [1].

4 Data Analysis and Findings

Of the analised data, 10% were in the age bracket between [48–63]; 20% were in the age bracket of [64+] and 70% of the interviewees were in the age bracket of between [32–47]. 40% of all the interviewees were construction managers responsible for a construction project with a value of between >R40 – R130 million and 60% for projects above R130 million. 40% of the interviewees were all under the age of 40 and they were held responsible for the projects greater than R40 million. It was concluded that young construction managers were given the responsibility and given the ability to manage relatively large construction projects at an early stage in their careers. It was also found that most of the surveyed construction companies use a coaching method, in which a young inexperienced construction manager is able to be mentored by a seasoned construction manager at an early stage in their career development [1].

The information obtained from the interviews are classified in Table 1. The key findings revolved around creating a positive work environment. The aim is to improve the work-life balance and the lifestyle of construction management staff where it is often neglected.

The participants believe that a robust and transparent rewarding system is an absolute requirement for an improved work environment. Another important factor is also the availability of resources which can relieve unnecessary stress and create a more productive environment. Other factors such as equity, progression opportunities, fairness, transparency, job security and socialising were also mentioned as enhancing the work environment quality.

This reinforced the idea of having both intrinsic and extrinsic reward system for a more balanced work environment. Bonuses, project incentives and company shares are extrinsic rewards or forms of performance renumeration that were regarded as more important in relation to the overall positive work environment experience [1]. However, the intrinsic reward or performance remuneration, which could be opportunities to progress; more challenging responsibility and recognition; were also highly regarded by the interviewees. An assessment of current job satisfaction and happiness was also done which indicated most of the interviewees were happy of the job they were doing due to the positive effect of the following factors:

- The dynamic nature of the industry
- The opportunity to work with different trade, and skills
- The possibility with corporate level

On the other hand lack of transparency and the issue of work-life balance for those with families was a negative factor.

Table 1. Interview summary of findings

	Positive work environment (lending to Improved lifestyle factors)	Reward system	The current state of job satisfaction (or happiness)
Information classification	• A robust and transparent rewarding system is required **(100% importance)** • Availability of the required resources **(40% importance)** • Equality and potentially inclusiveness of project managers by allocating shares **(30% importance)** • Providing progression opportunities; communication of short- and long-term goals, and visions; in addition to professional development **(30% importance)** • Fairness of job allocation and rotating people especially during weekend jobs **(30% importance)** • Job security **(30% importance)** • Socialise events within the company **(30% importance)**	**Intrinsic reward or performance remuneration,** which could be opportunities to progress; more challenging responsibility and recognition **Extrinsic rewards or performance remuneration**, such as bonuses, project incentives and company share.	The dynamic nature of the industry makes it interesting and rewarding for most project managers **(positive)** The opportunity to work with different trade, with different skill sets is satisfactory **(positive)** The possibility to interact with other sides of the company such as corporate level **(Positive)** Lack of transparency at the corporate level **(negative)** However, the issue of work-life balance difficulty especially for those who have families could be problematic **(negative)**
Interviewees	Construction Director; Project Manager; Company MD; Contracts Manager; Senior Site Agent; Site Agent; Contracts Director; Contracts Manager; Project Manager; Site Agent		

Table 1 conceptualises the potential strategies and provisions required to create job satisfaction and a positive work environment. This is done to ultimately enhance motivation for the valuable project participants, resulting in construction management retention and stability.

5 Conclusion

The extrinsic rewards weight accounted for 26% of the responses and were noted as being slightly more important than intrinsic rewards, with 18% of the weighted responses. A good salary by itself was not considered as being the sole motivator with regard to retaining a construction manager's services. What was interesting from the surveyed findings was that the value of a positive work environment accounted for 55% of the weighted responses. Less money in lieu of negative environment was noted as more valuable. This concept is further reinforced by the fact that the construction companies must invest effort into creating a positive motivating environment.

In summary, the results confirmed that to successfully retain construction managers in a company, the following three main factors are needed; motivating environment, extrinsic and intrinsic rewards.

References

1. Van Heerden, A.H.G., Burger, M., Zulch, B.: The road to purpose-fit selection of the construction manager. Doctoral dissertation. University of Pretoria, Pretoria, South Africa (2018). http://hdl.handle.net/2263/67931
2. Sherrat, F., Farrell, P: Introduction to Construction Management. 1st edn. Routledge, New York (2015)
3. McKeon, J.J.: Becoming a Construction Manager: A Guide to Careers in Construction. Wiley, Hoboken (2011)
4. Jackson, B.: Construction Management: Jump Start. 2nd ed. Wiley Publishing Inc., Indiana (2010)
5. Kreitner, R., Kinicki, A.: Organisation Behaviour, 5th edn. The McGraw-Hill Companies, Inc., New York (2001)
6. Smit, P.J., Cronje, G.J. de. J.: Management Principles: A Contemporary Edition for Africa. 2nd ed. Cape Town. Juta & Co (Ltd.) (2001)
7. Strydom, Bruwer, De Beer, Holtzhausen, Kiley, Maritz, Nieuwenhuizen, Oosthuizen, Rudansky-Klopper, and Steenkamp: Principles of Business Management. 3rd edn. Cape Town, South Africa, Oxford University Press Southern Africa. (2015)
8. Coetsee, L.D.: Peak performance and productivity: a practical guide for the creation of a motivating climate (2002)
9. Swanepoel, B., Erasmus, B., van Wyk, M., Schenk, H.: South African Human Resource Management: Theory and Practice. 2nd edn. Juta & Co (Ltd.), Cape Town (2000)
10. Walker, A.: Organisational Behaviour in Construction, 1st edn. UK, Wiley-Blackell (2011)

Emotional Work, Mental Health and Organizational Management, Determinants in High Performance Teams. Results in Colombian Companies

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Abstract. The service companies in Colombia, as part of their organizational management actions, see in the standards and policies of customer service, a projection for their sustainability in the market. Methods, mixed type study with a descriptive approach, carried out in 7 service companies, with 129 workers. The workers signed the informed consent for the collection of information. Application of the instrument battery questionnaires for the evaluation of psychosocial risk factors, which has reliability levels for intra-labor conditions of 0.957 and stress of 0.83 [1].

Accidents reported in workplaces are associated with stress situations caused by emotional states after a stressed interaction with a user. It is necessary to design training programs to develop socio-emotional skills.

Keywords: Emotional work · Industrial psychology · Cognitive ergonomics · Organizational management · Psychosocial management

1 Introduction

The International Labor Organization (ILO) defines work as "the set of human activities, whether paid or not, that produce goods or services in an economy, or that meet the needs of a community or provide the necessary means of livelihood for individuals " [2].

Work constitutes for man as an activity that implies the development of physical and mental effort in the production of goods or services in order to respond to human needs. Thus, with its development it offers the possibility of subsistence to those who carry it out.

The functions developed at present, incorporate components that have a direct influence on the health of workers, consequently on business productivity. Therefore, the organizational dynamics have the responsibility to identify, evaluate and adequately monitor the psychosocial risk factors that affect those who work in the institutions. The

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objective is to intervene through appropriate strategies, the triggering situations of effects on individual and organizational health.

The ILO Encyclopedia in the chapter referring to psychosocial and organizational factors mentions that there are conditions, which lead to occupational stress with adverse effects on health and safety at work. Among the psychosocial factors, we find those related to the job, the work environment and the individual, such as the climate or culture of the organization, work functions, interpersonal relationships at work and the design and content of the task, among others [3].

The psychosocial risk factors act as psychosocial disruptors in the organization with negative effects on the physical and mental health of the worker [4], that triggers alterations that make you lose work and work capacity [5].

The organization in its adaptation to the constant changes in the market and to guarantee its permanence in it, has generated strategies that the worker must apply to satisfy the client. In this interaction, the worker must apply in his conduct, attitudes that lead the client to the acquisition and approval of the good or service.

For Mababu Mukiur (2012), Emotional work is a "multidimensional construct that refers to the expression of organizationally desirable emotions to influence interactions with clients or users at work" [6].

Arlie Russell Hochschild first introduced the concept of emotional work in 1983 with the publication of the book The Managed Heart, the Commercialization of Human Feeling, where he studies two service jobs: flight attendants and collectors, where the first sells a service and the other charges for the service, requiring high emotional work. Hochschild defines emotional work as the control of feelings to create publicly observable bodily and facial manifestations [7].

The service companies in Colombia, as part of their organizational management actions, see in the standards and policies of customer service, a projection for their sustainability in the market. The development of customer service protocols leads to workers maintaining an attitude with a high degree of enthusiasm and kindness, denying the possibility of expressing authentic emotions in the interaction with the client. This situation causes in the workers alterations in their physical and mental health, which they register within the absenteeism indicators of the company.

The Colombian Ministry of Labour reports, two out of every three workers showed alterations due to psychosocial risks, and that they feel high levels of stress between 20% and 30%.

60% of workers interact with users. In addition, there was a 43% growth in mental and behavioural disorders between 2009 and 2012, especially due to anxiety and depression events [9].

With the previous indicators, you can see the need to identify the effects that emotional work has on the mental health of workers, on the organizational management of the company and on high performance teams for the production of services. First determining the sociodemographic conditions that influence them; secondly, identifying the emotional work practices that trigger psychosocial risk factors; also classifying the processes of organizational management in which emotional work is present and finally determining exposure with risk levels.

This work focuses its analysis on the implications that the worker and the company have in the development of emotional functions. Taking into account that, in the production of services, this function is basic for work performance and constitutes the differentiating value in the provision of the service because it is part of the corporate image.

2 Method

Mixed study, with descriptive scope of emotional conditions triggered by users and co-workers that have the potential to influence the operational environment of the production of the service as basic information for the development of intervention programs from organizational management to the quality of Work life and well-being.

Population of 129 workers of 7 health units in Bogotá. Sample, not probabilistic of voluntary participants.

2.1 Steps Taken for the Study

For the development of the study the following steps were fulfilled that allowed to guarantee an adequate procedure to obtain the results:

Step 1 "Information campaign". Dialogue with workers and invitation to participate in the study. This activity allowed us to explain the objective and implications of the study. With this space, the workers who would go to step 2 were identified.
Step 2 "Informed consent signature" [11]. The workers who agreed to participate in the study signed this consent, in order to meet the ethical criteria of the investigation.
Step 3 "Application of the Instrument Battery for the Evaluation of Psychosocial Risk Factors". Delivery to each participant of the self-dilution formats. This battery with intra-labour reliability levels 0.957; and stress 0.83.
Step 4 "Verification of the psychosocial occupational medical records." After the application of the questionnaires, the information processed under the methodology, showed the risk levels, these allowed identifying those who scored with medium, high and very high-risk levels.
Step 5 "verification of risk levels". For this step, a semi-structured interview with the workers is carried out [12], allowing to identify the veracity of the information recorded in applied instruments.
Step 6 "Preparation of general and individual reports". With the verification, a general report is made of the conditions of one of the 7 service units and the individual reports of the formats applied to each worker. This in order for the organization to know the real state of its working population and take measures to control emerging risks.

With these reports the company is suggested the preventive strategy to follow for risk control.

3 Results

Personnel mostly with technological and professional training in 83%, with an average age of 35 years, 68% of the workers have a definite term employment contract, a working day with average working hours between 6 and 18.5 h a day.

The correlations verified intra-labour factors that are altering the physical and mental health of the worker from the customer service function.

Main risk found in poorly structured training processes towards the development of socio-emotional skills reported by 89.3%, incorporation of personnel with low levels of socio-emotional competence at 73%, due to recruitment and selection processes with tests that are not adequate.

48% affected by stress in the physiological symptoms of disorders, such as headaches, frequent flu and sleep disorders; intellectual symptoms, expression of decreased work performance and permanent tiredness, feelings of frustration; psychoemotional symptoms; feelings of anguish, anger and rigid behaviours and for social symptomatology; and feeling of isolation.

Accidents reported in workplaces are associated with stress situations caused by emotional states after a stressed interaction with a user.

When reviewing the disabilities reported by workers, it was found that the greatest number of these occur in periods where the attention rate is high.

4 Discussion

Workers who carry out activities that incorporate "emotional work" functions have a greater tendency to develop situations of emotional disturbances that eventually trigger episodes of anxiety and depression.

Emotional disturbances influence the quality of work and family life, because this alteration has the potential to transcend their family sphere, putting the worker in a greater vulnerability caused by the change in their behaviour and the weakening of their family relationship that In many cases it is presented.

An organization that carries out its activity without knowing that the worker requires prior skills or the development of the same, is directed to the occurrence of a greater number of workers who are sick or affected by a psycho-emotional situation, leading them to unnecessary expenses and greater losses in your operation

5 Conclusions

Organizations have the responsibility to establish preventive measures from the moment they begin the search for who their contracted collaborators will be.

Communication, training and information strategies become organizations in a fundamental element in the process of mitigating or eliminating said risk, so that they are within the stages of recruitment, hiring and permanence of the worker in the company.

The development of emotional competencies in a service organization constitutes the fundamental priority.

An organizational strategy focused on the improvement of human processes constitutes the best investment in the processes of attention and service.

References

1. Ministerio de la Protección Social: Batería de Instrumentos para la evaluación de factores de riesgo psicosocial (2010)
2. Levaggi, V.: ¿Qué es el trabajo decente? https://www.ilo.org/americas/sala-de-prensa/WCMS_LIM_653_SP/lang–es/index.htm. Accessed 30 Jan 2020
3. OIT: Enciclopedia de Salud y Seguridad en el Trabajo (1998)
4. Piñeros, O., Marin, C.: Psychosocial Toxicity in Colombian Service Companies (Toxicidad psicosocial en las empresas de servicios de Colombia) (2019)
5. Piñuel, Y., Zabala, J.: Evaluación psicológica del acoso psicológico en el trabajo o mobbing en España mediante el cuestionario Cisneros (2015). https://eprints.ucm.es/33244/
6. Mababu, R.: El constructo de Trabajo emocional y su relación con el Síndrome del Desgaste Profesional. Int. J. Psychol. Psychol. Ther. **12**, 219–244 (2012)
7. Hochschild, A.R.: The managed heart: commercialization of human feeling. University of California Press, Berkeley (2003)
8. Fasecolda: Se reducen las enfermedades laborales, pero aumentan las incapacidades en Colombia (2019). https://fasecolda.com/sala-de-prensa/fasecolda-en-linea/noticias/noticias-2019/noviembre/se-reducen-las-enfermedades-laborales-pero-aumentan-las-incapacidades-en-colombia/
9. Mintrabajo: Bienestar y salud mental: un compromiso de MinTrabajo y el Sector Público (2019). http://www.mintrabajo.gov.co/web/guest/prensa/comunicados/2019/julio/bienestar-y-salud-mental-un-compromiso-de-mintrabajo-y-el-sector-publico
10. Hernández, R., Fernández, C., Baptista, P.: Metodología de la Investigación. Mcgraw-Hill/Iinteramericana Editores, S.A. de C.V, México (2014)
11. Ministerio de la Protección Social: Resolución 2646 Identificación, Evaluación, Prevención, Intervención y Monitoreo Permanente de la Exposición a Factores de Riesgo Psicosocial (2008). https://tinyurl.com/y9mnbo8a
12. Ministerio de la Protección Social de Colombia: Batería de instrumentos para la evaluación de factores de riesgo psicosocial. Imprenta Nacional de Colombia (2010)

Meta-Analysis of Job Satisfaction Amongst Different Occupations

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Abstract. Job satisfaction is significant to the development of organisations and well-being of workers. This concept is important for retaining workers, improving productivity, enhancing employee loyalty and increasing profit. Given that no meta-analysis has been conducted to compare job satisfaction amongst different occupations, this study analyses the level of job satisfaction amongst different occupations through a meta-analysis. The occupation with the highest value of odds ratio (OR) with job satisfaction is drivers, followed by office workers, disciplined services, nurses and physicians. By contrast, the occupation with the lowest OR is teachers. Job satisfaction is positively associated with a high tendency of suffering from occupational fatality. In addition, job satisfaction is related with turnover, productivity and revenue of organisations. However, the high occurrence of occupational fatality might affect the attitude of organisations on whether they should boost workers' job satisfaction.

Keywords: Job satisfaction · Meta-analysis · Occupations · Occupational fatality

1 Introduction

Job satisfaction is a complex concept that lacks ultimate definition. Numerous scholars have suggested different definitions for job satisfaction. In 1935, Hoppock [1] defined job satisfaction as a feeling of contentment based on the combination of physiological, psychological and environmental conditions. In 1964, Vroom [2] stated that job satisfaction mainly emphasises role in the workplace. Herzberg [3] proposed the two-factor theory in 1976 and argued that motivators (i.e. achievement, recognition, work, responsibility, advancement and growth) lead to job satisfaction. Subsequently, Davis [4] suggested that job satisfaction is tightly linked to a worker's behaviour in the workplace. Job satisfaction is recently defined as sense of achievement at work, enthusiasm for work, happiness with work [5], attitude toward the job [6] and personal feelings on the material and mental needs from the job [7].

Various internal and external factors related to work affect job satisfaction. Job satisfaction can affect the attitude and behaviour of workers, thereby increasing organisational commitment [8], lowering turnout intention [9, 10] and improving work performance

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[11]. Job satisfaction is apparently a critical factor influencing organisation development. Moreover, different occupations have distinct job natures and working environment. Job satisfaction varies amongst different occupations. A meta-analysis is conducted to identify the discrepancy of the level of job satisfaction amongst different occupations. To our knowledge, a lack of meta-analysis that investigates job satisfaction amongst occupations is evident. Therefore, a meta-analysis on the difference in job satisfaction amongst different occupations must be conducted to enable professionals in human resource management to understand current circumstances and assist in addressing the problems.

2 Methods

2.1 Literature Search and Selection

Several electronic databases, namely, Google Scholar, Web of Science and Scopus, were used from Feb 6 to April 25, 2018. The keywords "career development" OR "co-workers" OR "colleagues" OR "job satisfaction" OR "pay" OR "promotion" OR "salary" OR "supervisors" OR "working environment" were searched in the databases to obtain the published papers. The abstracts of the collected papers were sifted. The papers used for the meta-analysis should meet certain requirements. In particular, the papers should 1) be empirical studies instead of qualitative studies, 2) include odds ratios (OR) (otherwise, sufficient sample sizes were provided for calculating OR) and 3) English publications. A total of 283 out of 1,437 papers were extracted in the initial selection. Subsequently, papers with no provision of confidence interval of 95% for OR, duplication and sample, including more than one occupation that could not be separated, were excluded. Consequently, a total of 63 papers were extracted.

2.2 Statistical Analysis

Data analysis was conducted by using the Comprehensive Meta-analysis 3.0 software package. The OR and confidence interval of 95% of job satisfaction were extracted. Fixed effect models were used because common treatment effects were assumed in all studies. I^2 reflects heterogeneity, i.e. consistency of results. A high value of I^2 implies a high level of heterogeneity [12]. Three variables, namely, publication year, country and occupational fatality were selected for conducting moderator analysis to evaluate the potential effects of heterogeneity.

3 Results

3.1 Fixed Effect Models

The number of studies for disciplined services, drivers, nurses, office workers, physicians and teachers are 9, 8, 14, 9, 12 and 8, respectively. Amongst the six occupations, drivers have the highest value of OR (OR: 1.573, 95% confidence interval CI: 1.331–1.858), followed by office workers (OR: 1.570, 95% CI: 1.551–1.590), disciplined services (OR: 1.563, 95% CI: 1.488–1.642), nurses (OR: 0.094, 95% CI: 1.069–1.120) and physicians (OR: 1.016, 95% CI: 0.997–1.037).

I^2 value is used to evaluate heterogeneity. The I^2 values of disciplined services, drivers, nurses, office workers, physicians and teachers are 34.423%, 0.000%, 88.572%, 0.00%, 95.105% and 84.722%, respectively. The I^2 values of drivers and office workers lack heterogeneity. Thus, a subgroup analysis was conducted for disciplined services, nurses, physicians and teachers to identify the possible effects of heterogeneity. Table 1 demonstrates number of studies, effect size and heterogeneity amongst the six occupations.

Table 1. Number of studies, effect size and heterogeneity amongst disciplined services, drivers, nurses, office workers, physicians and teachers

Occupation	No. of studies	Effect size and 95% interval			Heterogeneity	
		Overall OR	Lower limit	Upper limit	P-value	I^2-value
Disciplined services	9	1.563	1.488	1.642	0.143	34.423
Drivers	8	1.573	1.331	1.858	0.988	0.000
Nurses	14	1.094	1.069	1.120	0.000	88.572
Office workers	9	1.570	1.551	1.590	0.940	0.000
Physicians	12	1.016	0.997	1.037	0.000	95.105
Teachers	8	1.011	0.943	1.084	0.000	84.722

3.2 Moderator Analysis

Publication year, country and occupational fatality were adopted as moderators to assess heterogeneity for job satisfaction of disciplined services, nurses, physicians and teachers. Publication year contained two subgroups, namely, 1988–2002 and 2003–2018. All studies that investigated job satisfaction amongst teachers were published after 2002. Thus, no comparison could be conducted. Country is categorised into two subgroups, namely, Asian countries and Western countries. Occupational fatality was classified into high occupational fatality and low occupational fatality. In particular, disciplined services were classified under high occupational fatality, whereas nurses, physicians and teachers were classified under low occupational fatality.

Publication year exhibits significant effects on job satisfaction amongst nurses and physicians (p-value < 0.000). The publication of nurses and physicians from 1988 to 2002 reveals a stronger association with job satisfaction than the publication from 2003 to 2018.

Country shows significant effects on job satisfaction amongst nurses, physicians and teachers (p-value < 0.000). The job satisfaction amongst these three occupations is stronger in Western countries than in Asian countries.

Occupational fatality exhibits significant effects on job satisfaction amongst disciplined services, nurses, physicians and teachers (p-value < 0.000). Job satisfaction of

the subgroup under high occupational fatality is stronger than that of the subgroup under low occupational fatality. Table 2 indicates the effects of publication year, country and occupational fatality on job satisfaction amongst disciplined services, nurses, physicians and teachers.

Table 2. Effects of publication year, country and occupational fatality on the job satisfaction amongst disciplined services, nurses, physicians and teachers

Moderator		Effect size and 95% interval			Heterogeneity	
		Overall OR	Lower limit	Upper limit	P-value	I^2-value
Publication year						
Disciplined services	1988–2002	1.727	1.429	2.986	0.059	71.951
	2003–2018	1.552	1.474	1.633	0.297	19.925
Nurses*	1988–2002	1.150	1.068	1.238	1.000	0.000
	2003–2018	1.088	1.061	1.115	0.000	89.266
Physicians*	1988–2002	1.090	0.786	1.512	1.000	0.000
	2003–2018	1.016	0.997	1.036	0.000	95.546
Country						
Disciplined services	Asian countries	1.653	1.526	1.791	0.103	48.058
	Western countries	1.511	1.419	1.608	0.683	0.000
Nurses*	Asian countries	1.052	1.024	1.081	0.000	87.180
	Western countries	1.215	1.162	1.271	0.000	84.394
Physicians*	Asian countries	0.985	0.966	1.006	0.000	95.948
	Western countries	1.695	1.562	1.840	0.038	51.003
Teachers*	Asian countries	0.948	0.841	1.068	0.164	44.714
	Western countries	1.045	0.959	1.138	0.000	90.124
Occupational fatality*						
High occupational fatality		1.564	1.491	1.640	0.634	0.000
Low occupational fatality		1.321	1.308	1.334	0.000	97.999

4 Discussion

The meta-analysis summarised the job satisfaction amongst disciplined services, drivers, nurses, office workers, physicians and teachers based on 63 papers and compared these six occupations. Drivers show the highest level of job satisfaction, followed by office workers, disciplined services, nurses, physicians and teachers. Given the lack of heterogeneity in the occupations such as drivers and office workers, a moderator analysis was conducted for disciplined services, nurses, physicians and teachers. Publication year, country and occupational fatality are found as significant moderators.

Publication year considerably influenced the effect sizes of nurses and physicians. Early publications exhibit higher OR than recent publication. Therefore, job satisfaction amongst nurses and physicians are declining. The decrease in the level of job satisfaction may be due to the changing organisation policies [13].

Country reveals a significant effect on the effect sizes of nurses, physicians and teachers. These three occupations in Western countries have a higher level of job satisfaction than those in Asian countries. This finding supports the previous study of Andreassi [14] who found that workers in Asia have a lower job satisfaction than workers in America and Europe.

Occupational fatality influenced job satisfaction amongst the occupations. Occupations with high level of job satisfaction had a higher chance of suffering from occupational fatality than those with low level of job satisfaction. Thus, further study should be conducted to investigate the association between job satisfaction and occupational fatality.

5 Conclusion

This meta-analysis synthesised job satisfaction amongst and compared six occupations, namely, disciplined services, drivers, nurses, office workers, physicians and teachers. Drivers reveal the highest job satisfaction, whereas teachers show the lowest job satisfaction. Occupational fatality occurs amongst occupations with high level of job satisfaction. Researchers can conduct further investigation to evaluate the phenomenon. Job satisfaction and occupational fatality are vital factors influencing the development and operation of organisations. Human resource management practitioners should be highly concerned about workers' conditions and take further actions to improve awareness about risky circumstances.

References

1. Hoppock, R.: Job Satisfaction. p. 47, Harper and Brothers, New York (1935)
2. Vroom, V.H.: Work and Motivation, p. 99. Wiley, New York (1964)
3. Herzberg, H.F.: Motivation-Hygiene Profiles, p. 20 (1976)
4. Davis, K., Nestrom, J.W.: Human Behavior at Work: Organizational Behavior, 7th edn., p. 109. McGraw Hill, New York (1985)
5. Kaliski, B.S.: Encyclopedia of Business and Finance, 2nd edn., p. 446. Thompson Gale, Detroit (2007)

6. Armstrong, M.A.: Handbook of Human Resource Management Practice, 10th edn., p. 264. Kogan Page Publishing, London (2006)
7. Aziri, B.: Job satisfaction: a literature review. Manag. Res. Pract. **3**, 77–86 (2011)
8. Altinoz, M., Cakiroglu, D., Cop, S.: The effect of job satisfaction of the talented employees on organizational commitment: a field research. Procedia Soc. Behav. Sci. **58**, 322–330 (2012)
9. Alam, A., Asim, M.: Relationship between job satisfaction and turnover intention. Int. J. Hum. Resour. Stud. **9**, 2162–3058 (2019)
10. Son, S.Y., Choi, J.S.: Effect of job embeddedness and job satisfaction on turnover intention in nurses. Korean J. Adult Nurs. **27**, 180–187 (2015)
11. Siengthai, S., Pila-Ngarm, P.: The interaction effect of job redesign and job satisfaction on employee performance. EBHRM **4**(2), 162–180 (2016)
12. Higgins, J.P., Thompson, S.G., Deeks, J.J., Altman, D.G.: Measuring inconsistency in meta analyses. BMJ **327**, 557–560 (2003)
13. Lu, Y., Hu, X.M., Huang, X.L., Zhuang, X.D., Guo, P., Feng, L.F., Hui, W., Chen, L., Hao, Y.T.: Job satisfaction and associated factors among healthcare staff: a cross-sectional study in Guangdong Province. China BMJ Open **6**(7), e011388 (2016)
14. Andreassi, J.K., Lawter, L., Brockerhoff, M., Rutigliano, P.: Job satisfaction determinants: a study across 48 nations. In: Tang, J. (ed.) Proceedings of 2012 Annual Meeting of the Academy of International Business-US North East Chapter: Business Without Borders. Sacred Heart University, Fair eld CT (2012)

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