

Jussi Ilari Kantola
Salman Nazir *Editors*

Advances in Human Factors, Business Management and Leadership

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Advances in Human Factors and Ergonomics 2019

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10th International Conference on Applied Human Factors and Ergonomics and the Affiliated Conferences

Proceedings of the AHFE 2019 International Conference on Human Factors, Business Management and Society, and the AHFE International Conference on Human Factors in Management and Leadership, held on July 24–28, 2019, in Washington D.C., 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 to 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 eleven sections are presented in this book. Each section contains research papers that have been reviewed by members of the International Editorial Board.

Part 1 Human Factors, Business Management, and Society

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- Section 2 Human Factors, Business Management, and Efficiency
- Section 3 Business Development
- Section 4 Business Management and Society: Market Views
- Section 5 Business Management and Society: Employment Views
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Part 2 Management and Leadership

- Section 7 Management and Leadership of Company and Organizational Cultures
- Section 8 Teamwork and Leadership Development

- Section 9 Leadership, Change Process, and Technology
 Section 10 Leadership Style and Social Aspects
 Section 11 Organizational Complexity and Leadership Management

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July 2019

Jussi Ilari Kantola
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Leadership Views



Enhanced Higher Education - Industry Cooperation Improving Work Capabilities of Sales Engineering Graduates

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Abstract. Sales engineers (SE) sell technical products and services to companies, and their results are crucial for their employers. They need technical knowledge and commercial competencies, but also management and soft skills, all fundamental for SE to be highly performant in their job. Students cannot learn this variety neither at university nor in industry alone. Instead, cooperation is required. Whereas academic-industrial cooperation for research or specific study programs is discussed in literature, this is not yet the case for enhanced industrial involvement in students' education. The authors present two case studies of industrial implication in students' education in Germany and France as benchmark and basis for a new approach of academic-industrial cooperation in education in Finland. This cooperation is developed in the frame of the project 'RADICAL - Filling Skills Gaps in Blue Industry by Radical Competence Boost in Engineering VET', co-funded by the Erasmus+ program of the European Union.

Keywords: Higher education · University-industry cooperation · AASE · Dual degree study program · Sales engineering · Blue Industry · Erasmus+

1 Introduction

Often, cooperation between higher education institutions (HEI) and industry is limited to internships, to punctual presentations, to company visits, to bachelor, master or doctoral theses, or to common research projects. If the company hires the student afterwards, still training is necessary. However, cooperation in education can go further for the benefit of students, universities and companies. Especially if those in the latter group are looking for well-trained and rapidly operational graduates to hire.

In 2017, four members of the Academic Association of Sales Engineering (AASE), together with industrial and institutional partners, submitted the proposal 'RADICAL - Filling Skills Gaps in Blue Industry by Radical Competence Boost in Engineering

VET' project under the coordination of Turku University of Applied Sciences (TUAS) which is currently funded by the Erasmus+ program of the European Union. The article presents models of Higher Education – Industry cooperation from Germany and France as the basis for the development of a radically different educational approach in Finland.

After a brief description of the RADICAL project objectives, the article describes existing experiences of industrial participation in students' education and related benefits. The article continues with a detailed case description of such cooperation in the different RADICAL partner's sales engineering study programs. The comparison of the different approaches allows key success factors of industrial involvement to be identified, which has been considered when developing the new RADICAL study program to be launched in autumn 2019 at TUAS. The article concludes with recommendations to improve Higher Education (HE) – Industry cooperation for the benefit of all parties.

2 About of the RADICAL Project

The European maritime technology industry is crucial for the economy and employment in Finland where around 30,000 people were employed and 8 billion euros' annual turnover was generated in 2014 [1]. The RADICAL project strongly focuses on supporting the competitiveness of the maritime sector; one of its main challenges lies in maintaining a qualified labor force. The overall project objective is closing the urgent skills gaps between the demands of working life and post-secondary vocational education and training (VET). A new and unique regional implementation model for post-secondary engineering education in Finland has been developed by the project partners and will start in autumn 2019 at TUAS.

The new RADICAL model is based on multidimensional regional cooperation where key partners also from the main target group. International partners from Germany and France participate by sharing their best practices in engaging companies to the enhancement of students' competences, utilized in the formative evaluation of forming the new RADICAL model.

3 Added Value of Academic-Industrial Cooperation for Education

The EU labor market is faced with a severe lack of skilled people which also challenges innovation in the EU industry [2]. The new EU-agenda for HE concludes that HEI and systems, which effectually in education, research and innovation, are needed to address these challenges successfully [2]. In several studies on persistent youth-unemployment after the financial crisis in 2009, it has been shown that especially those stayed longer unemployed who had a tertiary education without a link or cooperation with the industry [3]. Thus, employability of graduates is a key issue for HEI, looking to graduate students who know skills and competencies needed at work and requested by companies. The Bologna Declaration defines employability as ability to engage, to

maintain service and mobility in the labor market. Additionally, Stăiculescu et al. [4] state that e.g. the high number of young unemployed people in Romania reflects a reduced ability of university graduates to insert themselves into the labor market due to inappropriate study relevance and insufficient work-related skills.

Another indication for university-industry cooperation in the educational field is given by Edmondson et al. [5]. In the article, it is clearly indicated that real industry situations are needed to get students educated closer to the ‘real, confusing world’ of the industry.

In its renewed agenda for higher education, the European Commission states that *‘higher education should allow students to acquire skills and experiences through activities based around real-world problems, include work-based learning and, where possible, offer international mobility. Cooperation with employers can allow HEIs to increase the relevance of their curricula and deliver them effectively, and increase opportunities for students to access high-quality work-based learning’* [2].

Davey et al. [6] identified eight HEI-business cooperation areas by interviewing companies and HEI: (1) Collaboration in research and development (R&D), (2) Mobility of academics and (3) of students, (4) Commercialization of R&D results, (5) Curriculum development and delivery, (6) Lifelong Learning, (7) Entrepreneurship, and (8) Governance. The authors also state that cooperation forms offering more direct, measurable and promotable benefits are the most developed ones. Collaborative research activities are very important for many universities, and many literature analyses these cooperation especially on project level (e.g. [7–10]). Galan-Muros and Davey [11] set up a framework to describe university-business cooperation (UBC) in which human resources enter as input parameter. Industry is the recipient of researchers’, lecturers’ and students’ work. The potential influence in curriculum design is the only input from companies to HEI in this framework. One example for industry-driven degree programs is, e.g., described in [12]. In this example, lectures are mainly done by academics with industry related specific contents; industrial participation in teaching is negligible. Herring and Gu [13] describe challenges and benefits of successful industry involvement in students’ training in a design study degree in Canada. ESTA Belfort’s Chemistry/Biotech option has also been developed on the request and in cooperation with industry; it includes lectures done by professionals, company visits, and other industrial contributions to the degree program. Jackson [14] investigates how work placement design, content and coordination influence undergraduate employability skills. Interviewed students mentioned coaching and mentoring as particularly beneficial. Observing and evaluation professionals allowed them to further develop and refine the skills needed for professional success.

In the Bologna process, European Universities and Universities of Applied Sciences (UAS) have different orientations: While universities focus on study programs close to research, UAS’ study programs respond to practical industrial or business requirements. The authors know no literature that studies differences in employability of graduates from universities and UAS on a broader level; insights from a German study are therefore used for a first estimation [15]. The study about employability of bachelor graduates from universities and UAS analyses students’, graduates’ and companies’ answers gathered with questionnaires. Bachelor students evaluate practical orientation as well as job-related behaviors at UAS (68%–76% depending on the

studies) higher than at universities (23%–43%). Also, companies consider the short practical phases (e.g., internships) as the most important deficit and request a better link to reality in lectures, and students would like to have more HEI initiatives to associate companies in education. Sanchez also demands that private companies should be involved with the clear target, that such cooperation should be preferred, in which companies commit to the program by giving students a contract. This is supporting the transition from the higher education institution to the industry after the completion of the program [3]. Whereas literature on academic-industrial cooperation for education is poor, studies show that a better and more in-depth linkage between education and the real world is requested from students and companies and seem to bring a real added value to both. The following sections describe cooperation models from Germany and France as the starting point for the RADIAL curriculum development and future analysis and studies.

4 Academic-Industry Cooperation for Education: Case Studies from Germany and France

4.1 Dual Study Programs in Bavaria, Germany

To improve the employability of UAS graduates, Germany has introduced cooperative educational programs in the early 1970s. The state of Bavaria started its program “Hochschule Dual” in 2006, founded by the Hochschule Bayern e.V. (Association of the Bavarian Universities of Applied Sciences). This organization represents only UAS. The following data are given from [16] and [17]. Dual cooperative study programs combine studying at UAS with practical training in a company or institution. There are two models in Bavaria: “academic study with intensive in-company training” also called “Dual Study Program” (DSP) and “academic study combined with vocational training” or “Associated Study Program” (ASP).

The DSP is a combination of a regular study program at a participating UAS and working experience at an industry partner. Students start their DSP with an internship at one company. When subscribing to the UAS, latest in the third semester, the student and the company sign a contract, which is coordinated by the home-university of the student. During the entire subsequent program, the industry partner does not change for the student. However, there are exit options for both, student and enterprise.

When starting in the first semester, the student is full-time at the UAS. After the exams of the first semester, the student goes to work to his industry employer. With the beginning of the next semester, the student returns to the university. The full timeline of the DSP in Bavaria is given in Fig. 1. The example is showing the DSP for bachelor study programs with 7 semester and corresponding 210 credit points (CP) and those with 8 semesters and 240 CP. In the study programs, the fifth semester is also an internship, which is done at the student’s employer. For a seven-semester program, the student works 60 weeks in the company and finishes studies within 3 ½ years by graduating with a bachelor’s degree.

The ASP is a combination of a regular study program at a participating UAS and a professional apprenticeship at a company. A student starts the ASP with an

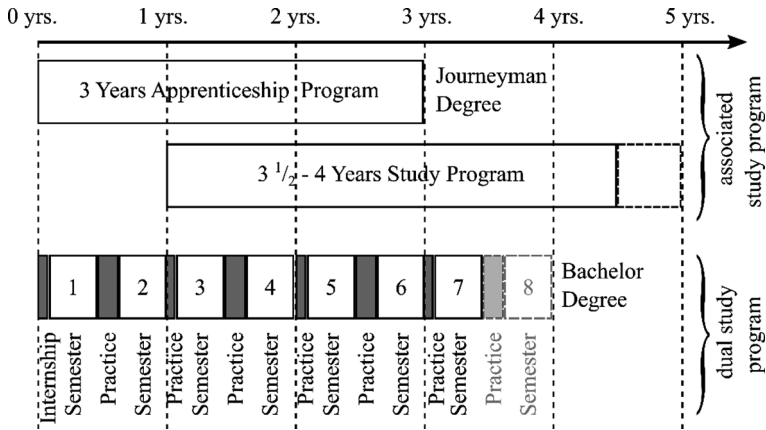


Fig. 1. Timelines of associated and dual study programs in Bavaria, Germany [16, 17], own graph.

apprenticeship for one year. A contract is signed at the beginning of the apprenticeship under the control of the UAS. Typically, the industry partner does not change for the student. Like for DSP, there are exit options.

After the first year of apprenticeship, the study program starts in parallel. When starting in the first semester, the student is full-time at the UAS. After three years, the student gets a journeyman degree. The study program continues until the regular end. The timeline of the Bavarian ASP is given in Fig. 1. After 4½ to 5 years, the student graduates with a bachelor's degree. The total time of working experience in the ASP is approximately 45 weeks longer compared to the DSP. Thus, in the ASP, participants have the option on two degrees whereas in DSP there is only one degree possible. As of today, 19 Bavarian UAS and the UAS Ulm in the state of Baden-Württemberg are taking part in the ASP and DSP.

Comparing both programs, it is clearly seen that DSP leads quicker to the bachelor's degree than the ASP. However, ASP offers two degrees. In the unlikely event that a student fails in the study program, he still finishes a job qualification degree.

The benefits of the ASP and DSP are an extensive practical relevance, public UAS in Bavaria do not charge any fees, financial support from the companies is secured by contracts. Gaining a permanent position at the company is very likely, key skills such as time management, self-organisation, structured working, and other are acquired on the job.

The state of Bavaria also runs a quality insurance program [18]. Here, UAS and industry have to commit to working times and payments, but also a secured level of education. The contract reflects these standards. The industry partner and the student sign the contract. The university is checking this contract with respect to the quality standards. Since their start in 2006, ASP and DSP see an increase in participating industry partners and students, Figs. 2 and 3 [16]. As the number of industry partners increases, it can be concluded that the Hochschule Dual is a success for the Bavarian industry. Despite an almost constant level of new students since winter term 2011/12

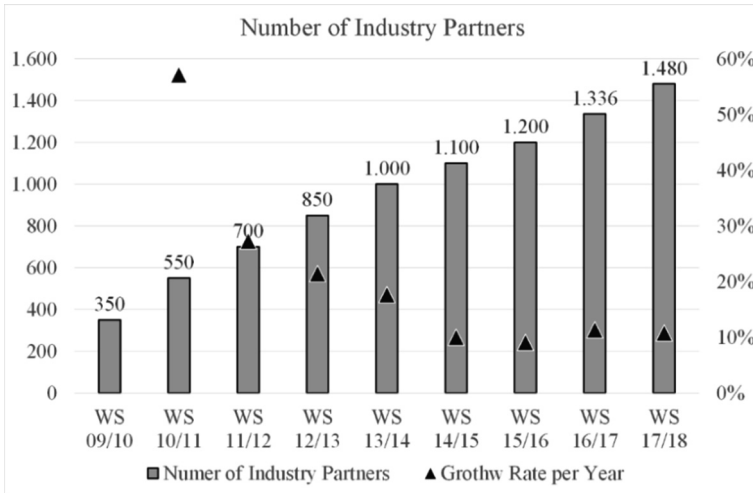


Fig. 2. Evolution of Industry Partners from winter term (WS) 2009/10 until WS 2017/18 [16], own graphic.

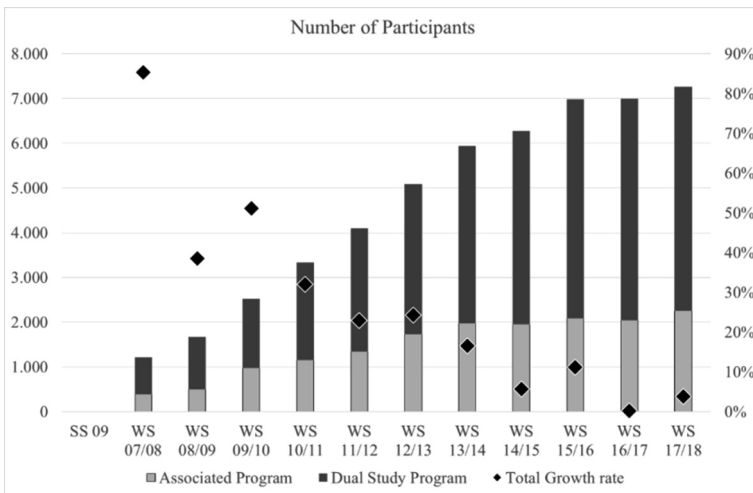


Fig. 3. Evolution of participating students in the Bavarian Hochschule Dual program from summer term (SS) 2006 until winter term (WS) 2017/18 [16], own graphic.

[19], the number of ASP and DSP participants is still increasing. This also indicated the success of the Hochschule Dual from the students prospective.

The UAS Aschaffenburg successfully runs both programs. In the study program on Sales Engineering ‘International Technical Sales Management’, companies address the UAS directly to bond with students at an early stage.

4.2 Multifaceted Academic-Industry Cooperation at ESTA Belfort, France

In the early '80s, Belfort industrialists could not find in French HEI qualified employees able to sell their technical products in global markets. When the Chamber of Commerce and Industry Belfort got some free budget following the abandon of a regional airport project, the members decided to create ESTA Belfort¹ and to train the sales engineers they needed themselves. The first class started in autumn 1986; today ESTA Belfort totals more than 1,000 graduates working on all continents. Students can enter directly after their A-level exams or with a two-year technical degree obtained in another HEI. The study program has the approval of the French Ministry of Higher Education. Even after more than 30 years, it is still unique in France.

At the beginning, the study program was built around three axes: technology, sales and marketing, as well as intensive language and intercultural training. In 2008, the study program passed to a five-year program to adapt to the Bachelor/Master system, and management topics were added as the fourth axis. The pedagogic program meets the demands of the AASE requirements for sales engineering studies [20]. Besides the initial technology-oriented sales engineering degree, a chemistry/biotech option was launched in 2015 at the request of the chemical and pharmaceutical industry in the Alsace and Basel regions. In 2019, a computer science option will follow. In both options, the technology subjects are substituted by option specific lectures, whereas the other lectures are common for all students.

A strong link with the industry characterizes the study program all the while, with activities taking place in companies' premises or at school. Each year, students have to do a thematically defined internship of three, five or six months embedded in the regular study year, Fig. 4, totaling a minimum of 20 months. The third-year internship is mandatory in a non-French speaking country, the fourth- and fifth-year internships can also be done abroad.

On the other hand, several actions are also taking place directly at school: Industrial experts are intervening in specific lectures, thus conveying their up-to-date knowledge as well as practical experiences and examples to the students. These interventions can be punctual on specific topics or for a whole lecture. During their fourth year, students work in groups on dedicated subjects given by companies. These "Applied Projects" last three months and allow students using their knowledge and ideas to answer to a real mission, but also to enhance their professional network with regard to future internships or even first jobs. Other actions are regular networking events or business breakfasts. The networking events are open to all students as well as ESTA Belfort's business partners and bring up to 150 to 200 participants. During the business breakfasts, a company presents its products or services to one specific class; the more unconstrained atmosphere facilitates discussions between the company representatives and the students.

¹ Ecole Supérieure des Technologies et des Affaires Belfort (ESTA School of Business & Technology), www.esta-groupe.fr

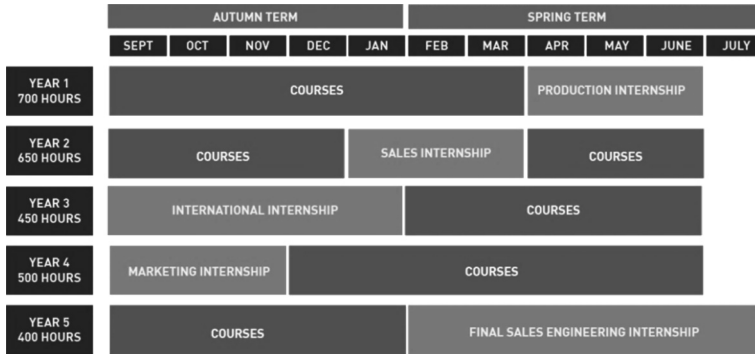


Fig. 4. Internship organization in ESTA Belfort’s five-year study program

Besides these actions organized by school, some students are member of a Junior Company where they realize missions such as e.g. market or feasibility studies for companies against payment.

ESTA Belfort offers a multitude of actions and activities enabling students to benefit from professional industrial in-depth experiences, to discover various types of companies and industrial sectors, and to enhance their network for their professional future during their studies. Feedback from companies underline the high and rapid operational readiness of students and graduates, and a recruitment rate of over 95% before the delivery of the Diploma confirms the success of this intensive and unique academic-industrial cooperation.

5 Need for Higher-Education-Industry Cooperation in Finland

It is estimated that the maritime sector within Southwestern Finland will need thousands of newly trained professionals by 2030, and it has been stated by the national and regional political entities that this will be a challenge to fulfil, since Finnish society is not used to solving educational needs of this magnitude [21]. New solutions in training and education are needed.

The vision in the Strategic Research Agenda for the Finnish Maritime Cluster 2017–2025 by Finnish Marine Industries and Ministry of Economic Affairs and Employment in Finland states that by 2025 Finland will have the most creative, agile and adaptive maritime network globally. This network will be recognized for providing customized solutions, services and operational forms delivered with flexible lead-time and cost-efficiently. These solutions will make the Finnish maritime sector a global role model and a necessary part of it is the education cooperation with HEI. A new generation of experts must be educated to maritime sector. It is also highlighted in the agenda, that the excellent theoretical education might not be enough. While a big number of current professionals are approaching their retirement age, also investing in sharing the tacit knowledge from experienced professionals is a key issue to success [1].

The Strategic Research Agenda continues, that the problems the industry faces are becoming more and more complex, and their solutions require e.g. critical thinking and creativity. Education must provide students with capabilities to multidisciplinary cooperation with other experts. Understanding well the requirements of the industry requires further strengthening of the cooperation between industry and HEI in developing the education towards the changing needs of industry and guaranteeing education for different fields of expertise in all levels of education. Increasing the number of Bachelors of Science and Engineering entering the industry is necessary [21].

The RADICAL project opens new paths for sustaining enterprise-HEI cooperation. Genuine systems where higher education students are studying on the workplace and are learning by doing does not exist as such in Finland. The RADICAL approach provides a new learning approach with an individual, dynamic and flexible learning environment, where theory can be integrated as a part of problem-based learning. Instead of one learning environment, by utilizing holistic learning, the learning environment can be almost anywhere. Students spend a substantial share of the degree program with real-life cases provided by the companies in the RADICAL network. This way students learn to utilize innovation competences as part of their work-based-learning and education. Therefore, the RADICAL approach could offer individually constructed degrees answering directly to the demand of maritime sector enterprises. This also leads also to an easier employment of students from vocational and higher education.

Finland has gone through a reformation of vocational education in 2017. One key element in this reformation was the increase of work place-based learning. Similar initiatives have been introduced to the learning models of UAS in different fields, but those have not been taken widely into use, and especially not within the engineering education. Naturally, the work internships or practical periods have been part of the Bachelor of Engineering curriculum already now, but a structured learning model between HEI and enterprise for work place related learning has been missing. The ENGINE learning model developed in the RADICAL project presents a solution for a structured HEI-enterprise learning model in Bachelor of Engineering education. It will be first piloted as part of the curriculum of Industrial Management and Engineering at TUAS in Finland. This degree program is used as pilot case and meets the maritime or maritime industry expectations very well, as e.g. critical thinking, innovation and multi-disciplinary cooperation are already part of the studies.

As a conclusion, the RADICAL project can be seen as a radical reformation of the HEI-enterprise cooperation in the Blue Industry sector as a whole. RADICAL offers new guidelines and maps and a model for students' and professionals' career paths towards new and better jobs in the shipbuilding industry as a part of the Blue Economy. A separate article published in 2019 by Jaskari, Holopainen, Reunanen, Schneider-Störmann, Röhr and Grotjahn describes the ENGINE learning model in detail.

6 Conclusion and Outlook

Both, the Belfort model as well as the Hochschule Dual in Bavaria show a clear strategy in joint educational programs between HEI and industry. At ESTA Belfort, there is a fixed five-year program including 300 CP, i.e., master's degree. In Bavaria, two different paths offer three to five-year programs with a range from 180 CP to 240 CP leading to a bachelor's degree. The ESTA Belfort degree program has several long-time internship periods whereas the Bavarian one focusses on smaller units during the study program.

All programs discussed take the industry into responsibility for the student's experience in industry work. Thus, the range for transferring this HEI-industry cooperation in education to the Finnish education system is wide and the RADICAL project team can benefit from the long-time experience of ESTA Belfort and the Hochschule Dual in Bavaria. As mentioned above, the framework of a new model is presented in another article by Jaskari, Holopainen, Reunanen, Schneider-Störmann, Röhr and Grotjahn in 2019.

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References

1. Ministry of Economic Affairs and Employment' of Finland Smart Maritime Technology Solutions. <https://www.finnishmaritimecluster.fi/research/>
2. European Commission: A renewed EU agenda for higher education; COM (2017) 247 final, Brussels (2017)
3. Sánchez, F.R.: Youth Unemployment in Spain: Situation and Policy Recommendations. Friedrich Ebert Stiftung, Berlin (2012)
4. Stăiculescu, C., Richițeanu-Năstase, E.-R., Dobrea, R.C.: The University and the Business Environment - Partnership for Education. *Procedia Soc. Behav. Sci.* **180**, 211–218 (2015). <https://doi.org/10.1016/j.sbspro.2015.02.107>
5. Edmondson, G., Valigra, L., Kenward, M., et al.: Making Industry-University Partnerships Work. <https://sciencebusiness.net/report/making-industry-university-partnerships-work>
6. Davey, T., Baaken, T., Galán-Muros, V., et al.: Study on the Cooperation Between Higher Education Institutions and Public and Private Organisations in Europe. European Commission, DG Education and Culture, Brussels (2011). ISBN: 978–992
7. Gulbrandsen, M., Smeby, J.-C.: Industry funding and university professors' research performance. *Res. Policy* **34**(6), 932–950 (2005). <https://doi.org/10.1016/j.respol.2005.05.004>
8. Roessner, D., Bond, J., Okubo, S., et al.: The economic impact of licensed commercialized inventions originating in university research. *Res. Policy* **42**(1), 23–34 (2013). <https://doi.org/10.1016/j.respol.2012.04.015>
9. Szücs, F.: Research subsidies, industry–university cooperation and innovation. *Res. Policy* **47**(7), 1256–1266 (2018). <https://doi.org/10.1016/j.respol.2018.04.009>

10. Rajaeian, M.M., Cater-Steel, A., Lane, M.: Determinants of effective knowledge transfer from academic researchers to industry practitioners. *J. Eng. Tech. Manag.* **47**, 37–52 (2018). <https://doi.org/10.1016/j.jengtecman.2017.12.003>
11. Galan-Muros, V., Davey, T.: The UBC ecosystem: putting together a comprehensive framework for university-business cooperation. *J. Technol. Transf.* **29**(6–7), 498 (2017). <https://doi.org/10.1007/s10961-017-9562-3>
12. Boër, C.R., Canetta, L., Pedrazzoli, P., et al.: Academic-industrial international cooperations for engineering education. *J. Intell. Manuf.* **24**(3), 433–439 (2013). <https://doi.org/10.1007/s10845-011-0545-1>
13. Herring, H., Gu, P.: Experience of Partnering with Industry to Enrich Engineering Design Education. In: PCEEA (2011). <https://doi.org/10.24908/pceea.v0i0.3889>
14. Jackson, D.: Employability skill development in work-integrated learning: barriers and best practice. *Stud. High. Educ.* **40**(2), 350–367 (2015). <https://doi.org/10.1080/03075079.2013.842221>
15. Briedis, K., Heine, C., Konegen-Grenier, C., et al.: Mit dem Bachelor in den Beruf: Arbeitsmarktbefähigung und -akzeptanz von Bachelorstudierenden und -absolventen, Positionen edn. Stifterverband, Essen (2011)
16. Hochschule Dual: Duales Studium in Bayern: Die dual Studierendenzahlen, München (2017)
17. Hochschule Dual Dual cooperative study options in Bavaria. https://www.hochschule-dual.de/cms/upload/broschueren/pdf/171213_ENGHsdFlyer_internationaleStudierende.pdf
18. Hochschule Dual Qualitätsstandards für das duale Studienangebot “Studium mit vertiefter Praxis” der Marke “hochschule dual”. https://www.hochschule-dual.de/cms/upload/dokumente/120604_Qualitaetsstandards_hsd.pdf
19. Bayerisches Landesamt für Statistik Studierende und Studienbeginnende an den Hochschulen in Bayern i WS 2017/18 und WS 2018/19
20. Reunanen, T., Röhr, T., Holopainen, T., et al. On the basis of the sales engineering competences and education. In: *Advances in Human Factors, Business Management*, pp. 160–172 (2018). https://doi.org/10.1007/978-3-319-60372-8_16
21. Ministry of Education and Culture in Finland: Positiivisen rakennemuutoksen osajaatarpeet. Selvitysmiehen raportti (2017)



Visualization of the Wisdom Cube Scientific Knowledge Space for Management and Leadership

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Abstract. Knowledge creation in organizations is crucial for their continuing existence. We are interested in querying and understanding what we know, how we know, what we do, and how we can justify everything so that we can lead and manage organizations. Therefore, it is important to follow the epistemological tradition, i.e., Episteme. This, however, is not enough, as reasoning has to go hand in hand with knowledge creation, i.e., Sophia, to know why things are done, what concepts are used, and what goals are possible. Techne, in turn, together with scientific and theoretical knowledge, develops new important technical and practical knowledge to make things happen. These three knowledge dimensions still lack real hands-on practical knowledge and wisdom, i.e., Phronesis, to show how and to know what should be decided. This research paper shows how the four different dimensions of knowledge can be used to understand the philosophical background of knowledge and wisdom creation.

Keywords: Cube · Episteme · Knowledge · Management · Leadership · Phronesis · Philosophy · Sophia · Techne · Wisdom · Visualization

1 Introduction

The philosophers of the Ancient World (700 BCE–250 CE) have inspired us by their writings to start thinking more deeply about the visualization of wisdom and knowledge [1]. The attempt here is now to put the basic principles in such a form that it is possible to show, in a practical way, how knowledge and wisdom are intertwined. Our aim is also to show how the definitions of the dimensions of wisdom give us the means to go further in our thinking to perceive and understand the important relationships between scientific, theoretical, technical, and practical knowledge. We can see this as a journey toward knowledge creation and wisdom. The starting point has been Ancient World philosophers and their thinking, but we do not have the same targets and goals as they had in their day [1]. Our target is more a practical understanding of knowledge creation and wisdom for management and leadership purposes

because we have seen that there is so much to get out of the philosophers' basic thinking [1], which we can then turn to the benefit of modern management and leadership.

In this introduction, we would like to start with the Greek philosopher Pythagoras (born in Samos, lived c. 570–495/7 BCE) [1], who combined philosophy and mathematics. His most important discovery was the relationship between numbers and proportions, finding the way to numerical harmonies. Pythagoras's theorem reveals that shapes and ratios are governed by principles that can be discovered and shown in mathematical and graphical ways [1]. He was the man who was first able to apply arithmetic to geometrical concepts like the "square" and the "cube" [2]. Many graphs/harmonies are therefore possible and have also been used here as a kind of innovation platform.

Socrates (born in Athens, lived c. 469–399 BCE) has been referred to as the founder of moral philosophy as well as one of the founders of Western philosophy and thus has also been named the greatest and best-known philosopher of them all. During his active time, he developed the dialectic Socratic questioning method as a dialog between opposing views and understanding. He challenged people in philosophical discussions with fundamental questions concerning morality and politics. One of his pupils was Plato, who recorded the most important works of Socrates [1, 2].

Plato (born in Athens, lived c. 427–347 BCE) described in his famous work 'the Republic', with his Allegory of the Cave, that understanding lies inside our minds as a world of ideas, or forms, which have nothing to do with the material world, and that our understanding and perception of this world are possible only through reason. According to Plato, this world of ideas is the true, actual "reality", not the world perceived by our senses [1, 2].

Aristotle (born in Stagira, lived 384–322 BCE), in turn, took a huge step forward by saying that Plato's theory of forms was wrong. Aristotle refuted Plato's theory with the Third Man argument by saying that if a man is a man because he has the form of a man, then a third form would be required to explain how man and the form of man are both men, and so on ad infinitum. Plato's background was in mathematics and Aristotle's as a researcher in the biological sciences. Aristotle based his thinking almost totally on observation, not on abstract concepts as Plato did [1, 2].

According to Aristotle [4], by relying on experiences of the world around us, through our senses, we get an idea of the characteristics of the world and can thus also understand inherent characteristics. After that, there are possibilities to study particular things and issues and conclude universal as well as immutable entities and truths [1]. All of the above concepts are somehow difficult for us to perceive, comprehend, and apply so that we obtain a holistic view of scientific, theoretical, and practical wisdom as well as knowledge generation. One view is that everything is in our minds; however, when it is articulated the other way around, i.e., that there are many different areas of knowledge that can be retrieved from data and information, people understand better how to create knowledge and where real knowledge exists.

Still, we have to go back and analyze what these philosophers teach us. There is much that their thinking can give us: especially how they view the different scientific, theoretical, methodological, and technical as well as practical knowledge needed to

understand the world around us. Their thinking also helps us to see how we can challenge our perception and understanding as well as current knowledge, knowledge creation and the new knowledge that changes our way of thinking, and especially how to make progress in the context of management and leadership.

In the following sections, we try to show the creation of the wisdom space and the planes of wisdom with the formation of the Wisdom Cube to provide a practical way of understanding knowledge and wisdom. The starting point is the four dimensions of wisdom.

2 The Dimensions of Wisdom

Wisdom is difficult to define both thoroughly and briefly. Wisdom is somehow internal as well as external. When it is in humans it is internal, i.e., tacit, and when it is external it is explicit knowledge that exists somewhere. It is also important to understand what wisdom is not. It is not data and it is not information. It is created and comes from processing data and information through reasoning and through observation. Thus, it is connected to humans in a systematic way, as humans are systems [3]. Often, however, the processes in humans seem to be intuitive and automatic, based on the structure and operation of the human brain.

Episteme, Sophia, Techne, and Phronesis were the main dimensions when wisdom was defined and articulated by the Ancient Philosophers [1]. Each dimension has its own specific content, but the boundaries with the others are fuzzy by nature and it may be better to describe them in terms of degree [8, 9].

In the following, we try to form a certain harmony with the nature of these wisdom and knowledge concepts. If we place Episteme on the Y-axis, Sophia on the X-axis, and Techne on the Z-axis we obtain a three-dimensional cube (see Fig. 1), in which the diagonal represents the dimension of Phronesis, i.e., it has relationships and interrelationships with each of the three other dimensions and their components, concepts, and sub-concepts.

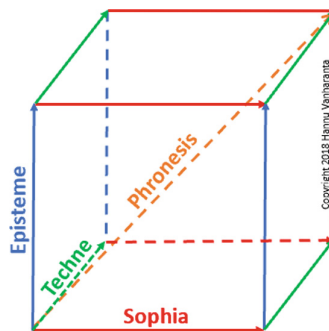


Fig. 1. The Wisdom Cube with the four dimensions of wisdom

The Episteme dimension on the Y-axis contains all scientific knowledge and can be defined as the scientific dimension of wisdom. Sophia on the X-axis contains all theoretical knowledge and shows the theoretical dimension of wisdom. In turn, Techne on the Z-axis represents technical knowledge and can be defined as the technical dimension of wisdom. The fourth (diagonal) dimension is the practical dimension of wisdom, i.e., Phronesis, which has connections, relationships, and interrelationships with each of the previous three dimensions of wisdom [5]. The graphical presentation above (Fig. 1) gives us the Wisdom Cube. The Cube, with its components, will be delineated and depicted in more detail in the following chapters.

2.1 Episteme - The Scientific Dimension of Wisdom

As Aristotle said in his Nicomachean Ethics [4]:

“Scientific knowledge is about things that are universal and necessary, and the conclusions of demonstrations and all scientific knowledge follow from first principles (for scientific knowledge involves apprehension of rational ground). This being so, the first principle from which what is scientifically known follows cannot be an object of scientific knowledge, of art, or of practical wisdom; for that which can be scientifically known can be demonstrated, and art and practical wisdom deal with things that are variable.”

This means that what is scientifically known can be demonstrated, and so things which are variable belong more to art and practical wisdom.

From the above, we can conclude that taking Episteme as a basis now demands a totally new type of teachable knowledge regarding management and leadership. We have to show and demonstrate better and better so that we obtain more universal as well as necessary knowledge for management and leadership purposes. We understand that in social sciences this is very demanding, but we see that it is nevertheless very natural and also practical to take the Episteme dimension and direction into consideration, especially if we use the other wisdom dimensions of Sophia, Techne, and Phronesis (see Fig. 2). A better scientific touch supports and improves the other areas of knowledge and wisdom.

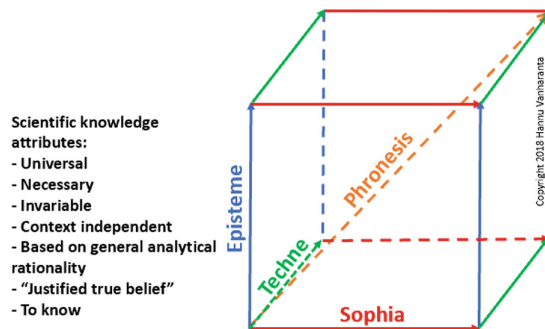


Fig. 2. Episteme - the scientific dimension of wisdom

In the management and leadership context, Episteme, the scientific dimension of wisdom, is therefore important; however, we cannot follow principles which are valid in the natural sciences like physics, chemistry, etc. We can only apply scientific knowledge in this management and leadership context and suppose that what we know is not even capable of being otherwise [4]. Therefore, the aspiration of scientific knowledge, Episteme, is also a necessity in this context. However, we understand that there are difficulties finding knowledge that is context-independent, invariable, necessary, and universal. The knowledge created is based normally on general analytical rationality. The target is to know and to create knowledge, i.e., “justified true belief”, that is as close as possible to the demands of Episteme.

2.2 Sophia – The Theoretical Dimension of Wisdom

The Ancient Greek word *Sophia* (σοφία, *sophía*) is the abstract noun of σοφός (*sophós*), which has been variously translated by the words “clever, skillful, intelligent, wise” [6], all of which characterize humans. Sophia has also been described with a wider conception as the theoretical dimension of wisdom [5, 6]. Theoretical knowledge, in turn, has been defined as knowledge of “why” something is true. This means that it is necessary to find explanations to state why certain truths are true. A deep understanding is then necessary, which requires reasoning concerning universal truths. Abstract concepts, as well as different contexts, make this reasoning difficult and many times the results do not fulfill the requirements (see Fig. 3).

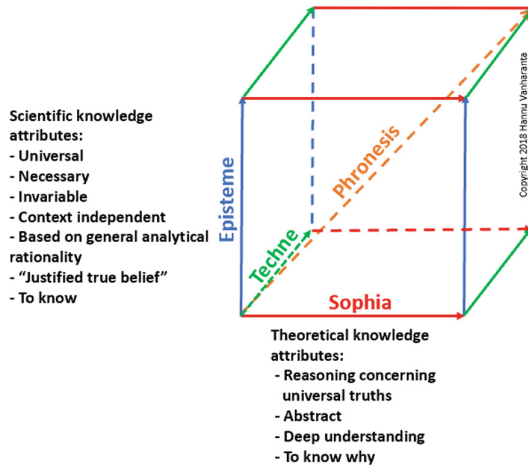


Fig. 3. Sophia - the theoretical dimension of wisdom

In business management and leadership, the question “why” is extremely important. Many cause-and-effect relationships and interrelationships are difficult to observe without clever, skillful, intelligent, and wise managers and leaders. This, however, is

not enough because knowledge also needs background theories, methodologies, and methods, which help to fix connections to quantitative data and qualitative information.

2.3 Techne – The Technical Dimension of Wisdom

A very good definition of what Techne means comes from Aristotle’s texts. He saw it as “representative of the imperfection of human imitation of nature” [4]. There are many examples that describe Techne as an activity, which is concrete, variable, and context-dependent. Carpentry has been mentioned in his texts as an example of Techne, as well as sciences like medicine and arithmetic. Often, Techne is thought of as more productive than theoretical, but Techne reveals its nature when people wish to obtain information concerning how to do something, i.e., technical know-how. It is also interesting that it fulfills the requirement of Episteme that it can be taught. This, in turn, is related to the people who are behind this knowledge and wisdom. Techne has connections to people who can make, know what is needed, know when the need exists, and also the context where something is needed. Techne is therefore very close to Phronesis, the practical dimension of wisdom (see Fig. 4).

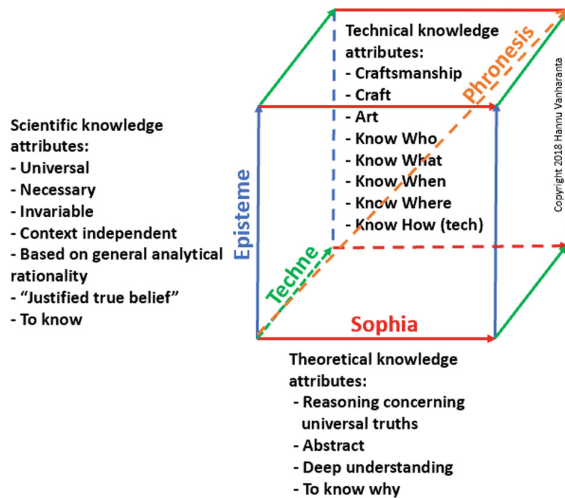


Fig. 4. Techne - the technical dimension of wisdom

Techne also has connections with communication, since people are connected to their cultures and communicate what they are going to do or make. Human ability, capacity, commitment, and motivation show what a person is going to do and make. Techne aims at deeds where activity or making leads to an end or an end product. Techne is close to the terms technique, technical, and technology, leading to production activities, processes, as well as other mechanical or material components of the real world [4].

2.4 Phronesis – The Practical Dimension of Wisdom

Practical wisdom, Phronesis, is the fourth dimension of wisdom in the Wisdom Cube. It is an Ancient Greek word for a type of wisdom or intelligence (Ancient Greek: φρόνησις, translit. *phrónēsis*) [7]. In his book, Nicomachean Ethics, Aristotle approaches Phronesis separately as one important area of wisdom [4]. It is more action-oriented but also includes the capability of rational thinking (see Fig. 5).

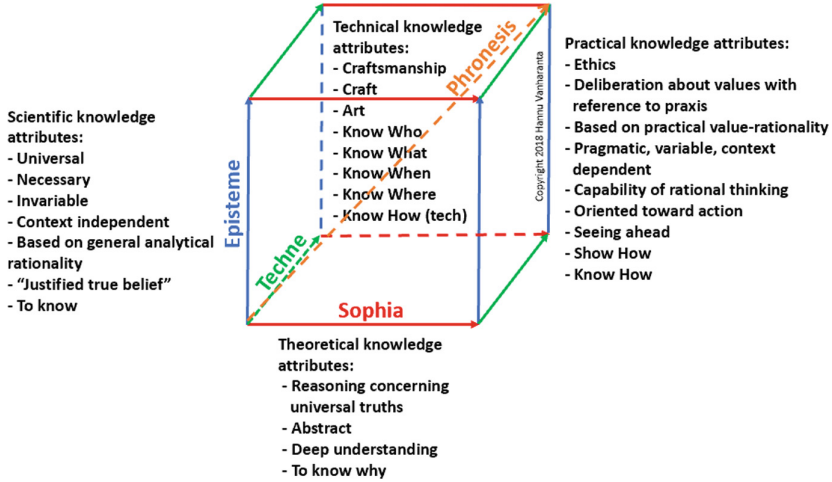


Fig. 5. Phronesis - the practical dimension of wisdom

Phronesis is based on practical value-rationality and the created knowledge is variable (not invariable) because it is very much a context- and situation-dependent dimension of wisdom. Phronesis emphasizes deliberation about ethics and values with reference to practical needs. In business management and leadership, added and shared values constitute increased value, which the organization can produce for humankind with its human as well as its fixed assets.

One sub-dimension of Phronesis is looking ahead to the future, i.e., the “power of foresight” [4], which is something which people trust to be important in their current situation. Many times this wisdom emerges when people know how and also when they are capable of showing how. Much of this wisdom and knowledge is connected to intuitive thinking in a specific context and situation and so we understand that Phronesis has connections to Episteme, Sophia, and Techne. Its pragmatic nature serves people well and deliberation of ethics and values keep it close to daily life. This dimension of wisdom is therefore very important in daily management and leadership when deep understanding and deliberation are needed.

“Practical wisdom, on the other hand, is concerned with things human and things about which it is possible to deliberate; for we say this is above all the work of the man of practical wisdom, to deliberate well, but no one deliberates about things invariable, nor about things which have not an end, and that a good that can brought about by action” [4].

Aristotle also teaches us by saying that practical wisdom needs a real understanding of particulars and this wisdom lies in people who have experience, and who are more practical than those who only emphasize universal knowledge and understanding [4]. This means that good and high-level practice should be focused on particulars.

At the end of this section on the practical dimension of wisdom, it is worth referring to Aristotle when he comments that learning is called understanding when it means the exercise of the faculty of knowledge [4].

3 The Planes of Wisdom

The planes of wisdom have been created with three vectors of wisdom as well as with the cube concept presented in Sect. 2. Each of the planes of the cube represents different areas of wisdom; however, in a way that with each vector we get two planes which have the same content. The planes of the constructed Cube of Wisdom are thus as follows: the Plane of Scientific and Technical Wisdom, the Plane of Scientific and Theoretical Wisdom, and the Plane of Theoretical and Technical Wisdom (see Fig. 6).

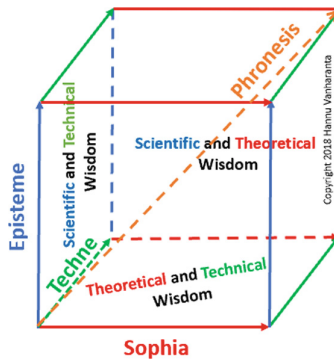


Fig. 6. The planes of wisdom

Inside the Planes of Wisdom there is the current Universe of Wisdom, i.e., all the wisdom humans have created during their existence. This is the wisdom and knowledge that humankind has, and it also describes the Space of Wisdom with its system boundaries and content. The Space of Wisdom is expanding and growing continuously in three directions (see Fig. 6). Outside the Space of Wisdom is the unknown, which is not yet available to us. Aristotle described this unknown in his Nicomachean Ethics, Book VI, 3, as follows:

“We all suppose that what we know is not even capable of being otherwise; of things capable of being otherwise we don’t know, when they passed outside our observation, whether they exist or not.” [4]

This unknown may be revealed to us in the future if we work hard and can make observations of the unknown. What then becomes known can be taught and will be the object of new learning and understanding.

Regarding management and leadership, the Wisdom Space of Management and Leadership has its own boundaries and its own planes and dimensions of wisdom. The categories and contexts of the Wisdom Space frame and shape many areas of wisdom and knowledge, depending on the context in question.

In the following, a short description of each of the Planes of Wisdom is presented.

3.1 The Plane of Scientific and Theoretical Wisdom

The Plane of Scientific and Theoretical Wisdom has two different wisdom dimensions and directions, i.e., the scientific Episteme and the theoretical Sophia. Scientific wisdom is what we know and what has been revealed through observations and experiments. Theoretical wisdom, in turn, is more a kind of deep understanding and utilizes answers to many “why” questions. Knowing why the world is like it is reveals the basic facts behind and reasoning concerning universal truths. This theoretical dimension can be abstract or concrete. To perceive and understand the content demands great capacity of the people who concentrate on creating more theoretical knowledge and wisdom. We can imagine this kind of knowledge through the planes of the Wisdom Cube, where we have real facts, truths, as well as theories that give us a new deep understanding of the world around us. We can also understand that interpreting problems with the help of reasoning in a given situation with a good theory can provide many new opportunities to find meaningful solutions to the problems in question. In social sciences, which is our context, namely management and leadership, we have to consider the fact that true knowledge might be difficult to achieve because the theories of management and leadership are often fuzzy and not as accurate as strict theoretical requirements demand. In physics and chemistry and other natural sciences, the situation is totally different and then the scientific and therefore the Plane of Scientific and Theoretical Wisdom has a different nature and characteristics [4].

3.2 The Plane of Theoretical and Technical Wisdom

The Plane of Theoretical and Technical Wisdom also has two dimensions: the theoretical Sophia and the technical Techne. Both the dimensions and directions have created an important area of wisdom and knowledge. Many technical discoveries are based on good theories; also the craftsmanship thinking in the Techne dimension provides possibilities to understand the practical side of the theories. Questions like know who, know what, know when, and know where, know how, etc. also fit extremely well with the theoretical reasoning concerning universal truths and abstract concepts. Craft and art aspects are different in Techne, but activating and making describe this direction very well [4]. Deep understanding through theoretical discussions and also making empirical tests will widen the Plane of Theoretical and Technical Wisdom.

3.3 The Plane of Scientific and Technical Wisdom

The third plane is the Plane of Scientific and Technical Wisdom. There are also two dimensions and directions, i.e., Episteme and Techne. The increase of scientific knowledge has given the technical side vast new opportunities in the modern world. Facts from scientific knowledge help craftsmanship and engineering to flourish, generating innovative and ever better products and services for humankind. In the modern era, we have experienced many new scientific discoveries, which have been turned into everyday products or services. In recent times computer sciences have taken the leading position to change the world, and help us solve complex multi-variable problems in many scientific, theoretical, and practical areas and contexts.

4 The Space of Wisdom

All three planes are components in building the Space of Wisdom. It is understood that by determining the characteristics and faculties of each plane we can construct a large space, which may have huge amounts of connections and interconnections. This kind of network is maintained and supported with the data and information we have put into the system and the outgoing knowledge can be extracted by the people using the data and information within. To obtain a holistic view of the dimensions, planes, and the Space of Wisdom, we have integrated everything into a single diagram (see Fig. 7).

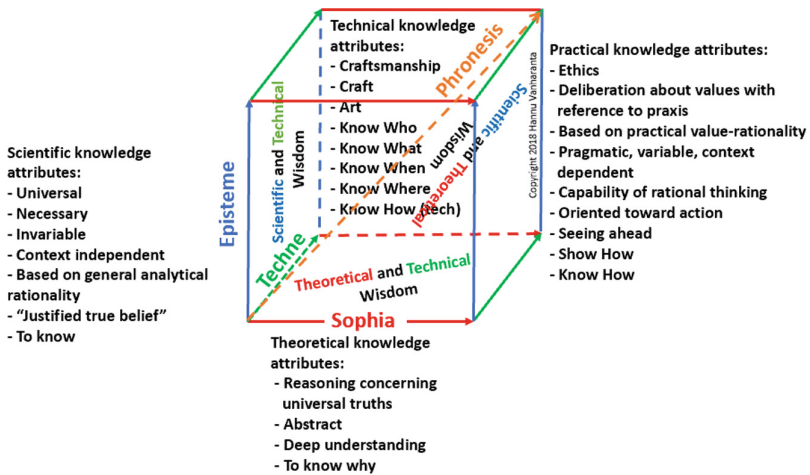


Fig. 7. The space of wisdom with the dimensions and planes of wisdom

Figure 7 shows very clearly that breaking down the construct into different characteristics helps us understand the nature of wisdom and it also shows how important it is to use this created knowledge for teaching purposes in the management and leadership context. Figure 7 allows us to go further and penetrate deeper into the secrets of

business knowledge in the specific context we have taken. Humans behave as active members inside this Space of Wisdom, as entities, i.e., as living systems [3].

The Planes and Space of Wisdom show clearly that the Ancient Philosophers reached a level of understanding that gives us great opportunities to see ourselves as members and owners of that ‘big wisdom’. The degree of wisdom in each plane can describe an individual’s position in the overall universal Space of Wisdom. A strong scientific, theoretical, and technical education throughout the Planes of Wisdom is one important path for managers and leaders to attain a strong position in their organization. For cross-scientific purposes as well as for teams and teamwork, it is important to concentrate on a verified and validated education, which increases knowledge creation in all dimensions. This process leads to high-level outputs in daily work on the individual level as well as on the collective level.

5 Discussion and Conclusions

This research is scientific, theoretical, technical, as well as practical for management and leadership purposes. The research derived from a keen interest in philosophy as well as management and leadership. The ideas for the content came from the discussions between the authors over many years as well as writing about new management and leadership concepts in different specific areas. The three-dimensional model, the Wisdom Cube, has been an integral part of our thinking for a number of years now and we consider that three-dimensional thinking has helped us immensely in understanding many new business ontologies as well as real business constructs and concepts.

The construct of the Wisdom Cube with the Dimensions of Wisdom as well as the Planes of Wisdom has helped us to demonstrate the concepts of knowledge areas in Episteme, Sophia, Techne, and Phronesis. The construct has also provided a strong base for further analysis of what it means in the context of management and leadership.

As a scientific contribution (Episteme), we can conclude that the visualization of the Wisdom Cube helps to understand the creation of scientific knowledge. The attributes of scientific knowledge clarify the requirements of “justified true belief”, which are clear demands for knowledge creation in the management and leadership context.

The theoretical contribution (Sophia) in this research helps us to understand the attributes of theoretical knowledge. The attribute “know why” focuses the reasoning process on answering why our management and leadership constructs, concepts, and variables produce important information for knowledge creation in specific business situations.

The technical dimension of wisdom and its relations to the other wisdom dimensions can be seen as an enabler. Many new scientific theories see the light of day through developed technologies. Techne transforms the scientific as well as theoretical discoveries and innovations for practical use. During recent years we have experienced many new technology services and products which help humankind in many ways. We can say that Techne converts human wisdom into practice.

The practical visualization of wisdom presented here, the Dimension(s) and Plane(s) of Phronesis, can be used first for education purposes. The attributes of Phronesis are

highly suitable for Ph.D. students and Master's students of business management and leadership. The Wisdom Cube, as a whole, is a clear metaphor, which students can remember easily, and which can hold the content as a foundation for their studies in the business context. The Cube is also relevant for managers and leaders already working in business. It shows in a practical way how important it is to continuously increase personal as well as collective knowledge creation in their organizations. The Phronesis attributes focus on a detailed deliberation about values from many directions. They also cover a large area of knowledge creation to understand what to do now, how to do it, as well as to see into the future so that the decision makers can support, lead, and decide the best possible paths for the characteristics of their own company. Important questions in perceiving, in deep understanding, as well as in knowledge creation are: Where are we now? Why are we here? Where should we be? and Are we getting there? To quote Aristotle [4]: "*Wisdom is intuitive reason combined with scientific knowledge.*"

References

1. Buckingham, W., King, P.J., Burnham, D., Weeks, M., Hill, C., Marenbon, J.: The Philosophy Book. Dorling Kindersley Ltd., London (2011). 352 p.
2. Magee, B.: The Story of Philosophy. Dorling Kindersley Ltd., London (2016). 240 p.
3. Miller, J.G.: Living Systems. McGraw-Hill Inc., New York (1978). 1102 p.
4. Aristotle: Nicomachean Ethics. Translated by Ross, W., D., Book VI, pp. 91–105. Batoche Books, Kitchener (1999)
5. Baehr, J.: SOPHIA: theoretical wisdom and contemporary epistemology. In: Timpe, K., Boyd, C. (eds.) Virtues and Their Vices, pp. 303–323. Oxford University Press, Oxford (2014)
6. [https://en.wikipedia.org/wiki/Sophia_\(wisdom\)](https://en.wikipedia.org/wiki/Sophia_(wisdom))
7. <https://en.wikipedia.org/wiki/Phronesis>
8. Trillas, E.: Lotfi A. Zadeh: on the man and his work. Scientia Iranica, D **18**(3), 574–579 (2011)
9. https://en.wikipedia.org/wiki/Lotfi_A._Zadeh



Value Creation in Three Clusters Focusing on Chemistry

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Abstract. In the presented study three clusters that focus into chemical industry were studied to explore value creation created by the cluster entities and the companies within the cluster by conducting qualitative remote interviews of 13 stakeholders located in three cluster of Smart Chemistry Park in Finland, InfraLeuna in Germany and Jurong Island in Singapore. The highest value created in the studied clusters was associated with collaboration. The second highest value created was considered to be the creation of networks (in itself related to collaboration), followed by infrastructure and development and innovation.

Keywords: Value creation · Clusters · Chemical industry

1 Introduction

Networks of companies in the form of technology centres, agglomerates, clusters, districts, science parks and incubators have existed in various forms almost as long as companies themselves have existed. They have been a part of one or several supply chain(s) or value delivering network(s) to create value by increasing revenue and profitability [1].

These networks of companies can be grouped together according to their specific industry (e.g. shipbuilding), or by the stage of the company (such as e.g. start-ups). The benefits brought by the network vary in great deal according to their location and purpose, but in general, are all related to gaining a competitive advantage by increasing value creation [2]. Clusters are defined to be geographic concentrations of interconnected companies, suppliers, service providers and associated institutions located in geographical proximity [3].

The clusters can be supported or even funded financially and otherwise by regional, national or global companies, funding and research agencies or governmental bodies. A great deal of variation exists between different countries in terms of legislation, support systems and even existence of clusters.

This research was conducted to analyse value creation within three known clusters that focus into chemical industry. The three studied clusters are Smart Chemistry Park in Finland, InfraLeuna in Germany and Jurong Island chemical hub in Singapore.

2 Clusters, Value and Value Creation

2.1 Clusters

Specific network, where homogenous group of actors are densely connected among themselves are called clusters [4]. Clusters are formed when a facilitating organization runs different activities for interconnected companies which are part of the entity. Normally the cluster companies are located in the same geographical region and operate in the same or similar industries [5, 6].

Clusters provide sources of locational competitive advantage seen in Fig. 1, where demand conditions are demanding customers, which can rely within the cluster entity itself or be common for group of cluster companies. The factor (inputs) conditions are natural, human and capital resources and physical, administrative, information, scientific and technological infrastructure. Within the clusters, these can be common or shared resources among the cluster companies [3, 7].

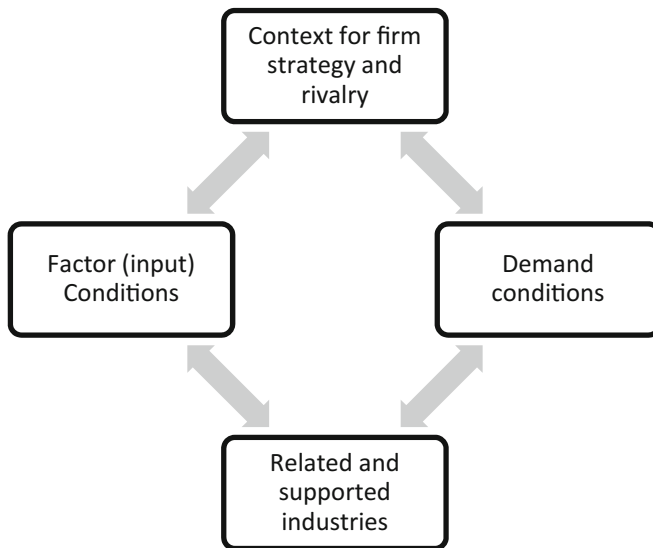


Fig. 1. Source of locational competitive advantage [3].

2.2 Value and Value Creation

Lindgreen and Wynstra [8] state that there is no universally agreed upon view of value. Regardless of the definitions, Raval and Grönroos [9] state that the ability of a company to provide superior value is regarded as one of the most successful competitive strategies and has become a means of differentiation and a key to find sustainable competitive advantage.

Depending from the literature and viewpoint, value in different forms can be defined, created, co-created, depend from values, be as propositions or linked to

stakeholders or customers or be as added value. The definition and viewpoint vary in great deal and depend a lot from the field of study and approach of the author, thus making holistic review of value and its creation quite challenging.

Möller took a wider view on value literature and stated that value studies have following four themes. One theme is that customer value is a subjective concept, second theme is that a value is a trade-off between benefits and sacrifices, third theme state that benefits and sacrifices can be multifaceted and fourth theme state that value perceptions are relative to the competition [10].

Value can be related to tangible product characteristics, such as product quality, delivery performance or service support, and intangible personal or company characteristics such as personal solutions, flexibility, or reliability, it can be related to the functions of the company such as marketing and R&D or competences, such as knowledge, learning and trust [10–14].

Value can be resources that are valuable, rare, imperfectly imitable and imperfectly substitutable. Bowman and Ambrosini [15] state that this kind of resources are organisations main source of sustainable competitive advantage. The resources can be goods, services, money, time, energy and feelings, emerging from interaction process or the combination and deployment of labour and other resources [12, 14, 15]. The value definition depends from perspective, making it subjective and individualistic [16].

Similar with the value definitions and literature, value creation can be seen part of the strategic process, making it central process for economic exchange and fundamental to companies' long term survival and growth [16–18].

Value creation is considered to be knowledge intensive and delivered by highly educated employees [19]. Therefore, value creation can be discerned to be related with competences, interactions or customer perception [20]. Value can be created by society, organisations or individuals to be used by individuals, clients, organisations, society or governments [21].

In general, value can be created in the internal processes of the companies such as innovation or R&D, and external processes such as new company creation or capital investments. Intangible processes such as knowledge creation, training or motivation can also serve as value creation platforms [21]. Results of value creation can be cost reduction, reduction of accident rates, improved decision making, solutions to problems, or better and easier life for customers [12].

One approach to value is to co-create value. This approach state that the organisations do not provide value, but instead they actively participate in a joint process where customers play an active role [16] and co-created value is a consequence of interaction and value in use as enactment of the value propositions that stakeholders express [14]. By this approach, co-created value needs to be done correctly and not to misuse resources and it is created in collaboration where activity of people involved determine the final outcome [14, 16, 22].

3 Value Creation in Clusters Focusing on Chemistry: A Case Study of Smart Chemistry Park, InfraLeuna and Jurong Island

The research was conducted by having semi-structured interviews of 13 company representatives, who either worked with one of the cluster entities or with a company within one of the studied clusters. After conducting the interviews, the data was sorted by utilizing categories, coded and analyzed. The time period of the interviews was three weeks during fall 2017.

The research was conducted by studying companies associated with clusters Smart Chemistry Park in Finland, InfraLeuna in Germany and Jurong Island chemical hub in Singapore. The studied clusters have existed for different time periods, are of different size, in a different stage of development and the companies associated with the clusters are different. The field of industry, chemistry, is common with all studied clusters.

The studied clusters are composed of different sized of companies. Micro, small, medium and large cluster companies were analyzed to find out value creation and its effects.

4 Research Findings

4.1 Benefits of Belonging to a Cluster

For the larger companies of the Jurong Island chemical hub and InfraLeuna the most important benefits of belonging to a cluster are related to infrastructure and access to facilities. It is vital for the survival of these clusters that its entity continues to maintain the infrastructures (such as power plants, pipelines and tanks) and facilities so that existing companies still feel they are truly beneficiaries of belonging to a cluster.

The importance of the cooperation was raised on all the interviewees' responses among companies of all sizes but especially within medium sized companies. This may be due to the fact that medium sized companies benefit the most from the heterogenic mix of small and large companies within a cluster. Having cooperation with both small and agile companies and large, multinational companies can bring the best of both worlds to these medium sized companies.

In addition to cooperation, most of the responses saw the benefit for belonging to cluster to be related that clusters provide facilities, infrastructure, shared equipment, and foment cooperation opportunities. Companies within the InfraLeuna and the Jurong Island chemical hub identified the highest benefits of the cluster to be with facilities and infrastructure, while in the Smart Chemistry Park, importance was given not only to facilities but also to cooperation. The companies associated with the Smart Chemistry Park have highlighted as core benefits common equipment, resources and community, while no mentioning of infrastructure was brought up.

4.2 Results Related to Value Creation

It was mentioned by the interviewees from the larger companies that the importance of infrastructure and exchange of goods and services in value creation. This can be easily understood, since for several of them, their customers are located within the cluster. This is particularly evident in the Jurong island chemical hub, where the production value chain is designed to deliver raw materials from one company to another. A similar approach is employed in InfraLeuna, but in a smaller magnitude.

The interviewees saw cost saving and revenue production as key financial aspects of value creation. A suggested way in which clusters could accelerate this would be through the previously mentioned value chain strategic planning.

Development and innovation are seen as highly associated with collaboration, network, shared knowledge and expertise, leading to value creation. These development and innovation activities were seen as high value creators by all companies involved in the studied clusters.

All clusters studies have specific strengths and specific areas that could be developed. In InfraLeuna, as implied by the name, the highest value is created by the infrastructure available at this cluster. The importance of collaboration, network and expertise as value creators in the Smart Chemistry Park can be associated with the close proximity, similarity in size and interest of the companies located in the cluster. It is recommended these value creators are accelerating even further. In addition to the value creators mentioned earlier, interviewees from the Jurong island chemical hub emphasise networks and power in unity.

4.3 Results Related to the Effects of Value Creation

The interviewees identified the main effects of value creation to lie with both financial benefits and information generation. Financial benefits were perceived to be related to both cost savings and increased revenue, generated by the network of the cluster companies and the cluster entities themselves. Companies can experience a reduction in their operational costs due from the close proximity of the other cluster companies, bringing added value as providers, customers and enablers. This was especially evident with the companies located in InfraLeuna and the Jurong island chemical hub and is a likely consequence of the value creators mentioned in the previous section, in particular the improvements brought about by the shared infrastructure.

Close proximity and social surrounding of other cluster companies, together with the cluster entity in itself provide the means to generate a wealth of information. The interviewees often expressed that belonging to a cluster leads to added value by virtue of new ways of thinking that provide solutions to problems and exchange of information. Sharing of information was also seen to lead to an improvement in decision making and enables common understandings to take place.

Companies associated with the Smart Chemistry Park and InfraLeuna highlighted new and existing customer contacts as an outcome towards value creation, likely caused by the existing cluster companies and the value created by the cluster entity itself.

There is a generalized consensus by the interviewees from all clusters in cooperation that more value creation is needed. Despite some preliminary meetings taking place to guide efforts in that direction, there is a clear need for increased cooperation. To accelerate cooperation, it is needed to generate ways of sharing information between not only cluster companies but also cluster entities as well and to allow for network in both digital and physical ways. These meetings would be particularly effective if facilitated by the cluster entity.

Both companies within the clusters and the cluster entities are interested in their own growth. For the companies, this can be achieved through better cooperation and better use of the value brought about by the cluster. For the cluster entities, this can be achieved through the addition new companies to the cluster.

In addition, in the Smart Chemistry Park, the need for new value creation in the areas of attitude and competences were identified. To avoid negative attitudes, such as “not invented here”, which limit sharing and acceptance of different approaches and solutions, more regular interaction between stakeholders is needed. For the development of more diverse business skills and wider competences, training in relevant topics by professional service providers is needed.

5 Conclusions and Recommendations

The highest value created in the studied clusters was associated with collaboration. The effects of collaboration are seen as paramount, with interviewees considering the creation of networks (in itself related to collaboration) as the second highest driver for value creation. In terms of importance given, this was followed by infrastructure and development and innovation. Companies associated with the Jurong Island chemical hub see the exchange of goods and services, power in unity and value chain created in the cluster as providers of most of the value creation. In addition, they also advocate collaboration, infrastructure, network, development and innovation as important value creators. Companies associated with InfraLeuna cite the highest value creation with infrastructure, collaboration, development and innovation and customers. The companies associated with Smart Chemistry Park mentioned collaboration, network and expertise, credibility, having a common project, development, and innovation as the biggest value contributors. For them, being part of a cluster provides common publicity and highlights their profile in national media.

The most impactful benefits of value creation were seen to be the exchange of information, financial benefits (especially in the form of cost savings) and the means to obtain new customers.

While larger companies would like to see more value creation related to cooperation, growth of the company and the expansion in the number of companies within the cluster, medium sized companies prefer to focus on attitude changes in order to create a non-competitive environment, more diverse competences and services (especially in sales and marketing). Small companies would like to see more value creation related to growth of their own company, competences development (e.g., in business skills) and more companies within the cluster. Micro companies would like to see an increase in cooperation.

Since collaboration and network are seen to be high value creators, it is recommended to all clusters to strengthen these activities by enabling possibilities for companies associated with the cluster to interact with each other. This could be achieved by generating possibilities for increasing networks, generation of joint projects and attracting customers with a joint approach. It is recommended this joint approach is used to increase credibility as a cluster and as a chemical industry stakeholder.

This study, its finding, conclusions and recommendations, cannot be generalised however, and should only be applied to the clusters involved. The small application of the study has to do with the generalisability of the performed analysis. The generalisability of the investigation findings, conclusions and recommendations is limited mainly due to the size of the study and research design of individual interviews, making the applicability to other time, place and people almost non-existing. The generalisability is good for the research design and sampling and analysis methods.

References

1. Blocker, C.P., Cannon, J.P., Panagopoulos, N.G., Sager, J.K.: The role of the sales force in value and appropriation: new directions for research. *J. Pers. Sell. Sales Manag.* **32**, 15–27 (2012)
2. Porter, M.E.: *On Competition*. Harvard Business Review Books, Boston (1998)
3. Porter, M.E.: Locations, clusters and company strategy. In: Clark, G.L., Feldman, M.P., Gertler, M.S. (eds.) *The Oxford Handbook of Economic Geography*, pp. 253–274. Oxford Free Press, Oxford (2000)
4. Levine, S.S., Kurzban, R.: Explaining clustering in social networks: towards an evolutionary theory of cascading benefits. *Manag. Decis. Econ.* **27**, 173–187 (2006)
5. Rubach, S., Johansen, F.R., Andersson, G.: Missing actions in cluster innovation. *Int. J. Adv. Corp. Learn.* **7**(1), 17–23 (2014)
6. Nelsen, L.L.: The role of research institutions in the formation of the biotech cluster in Massachusetts: The MIT experience. *J. Commer. Biotechnol.* **11**(4), 330–336 (2005)
7. Wennber, K., Lindqvist, G.: The effect of clusters on the survival and performance of new firms. *Small Bus. Econ.* **34**, 221–241 (2010)
8. Lindgreen, A., Wynstra, F.: Value in business markets: what do we know? Where are we going? *Ind. Mark. Manag.* **34**, 732–748 (2005)
9. Raval, A., Grönroos, C.: The value concept and relationship marketing. *Eur. J. Mark.* **30**, 19–30 (1996)
10. Möller, K.: Role of competences in creating customer value: a value-creating logic approach. *Ind. Mark. Manag.* **35**, 913–924 (2006)
11. Corsaro, D., Snehota, I.: Searching for relationship value in business markets: are we missing something. *Ind. Mark. Manag.* **39**, 986–995 (2010)
12. Aarikka-Stenroos, L., Jaakko, E.: Value co-creation in knowledge intensive business services: a dyadic perspective on the joint problem solving process. *Ind. Mark. Manag.* **41**, 15–26 (2012)
13. Porter, M.E.: *Competitive Advantage*. The Free Press, New York (1998)
14. 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)

15. Bowman, C., Ambrosini, V.: Value creation versus value capture: towards a coherent definition of value in strategy. *Br. J. Manag.* **11**, 1–15 (2000)
16. Diaz-Mendez, M., Gummerson, E.: Value co-creation and university teaching quality. *J. Serv. Manag.* **33**, 571–592 (2012)
17. O’Cass, A., Ngo, L.V.: Creating superior customer value for B2B firms through supplier company capabilities. *Ind. Mark. Manag.* **41**, 125–135 (2011)
18. Vargo, S.L., Maglio, P.P., Akaka, A.A.: On value and value co-creation: a service systems and service logic perspective. *Eur. Manag.* **26**, 145–152 (2008)
19. Lowendahl, B.R., Revang, O., Fosstenlokken, S.M.: Knowledge and value creation in professional service firms: a framework for analysis. *Hum. Rel.* **54**, 911–931 (2001)
20. Sullivan, U.V., Peterson, R.M., Krishnan, V.: Value creation and company sales performance: the mediating roles of strategic account management and relationship perception. *Ind. Mark. Manag.* **41**, 166–173 (2012)
21. Lepak, D.P., Smith, K.G., Taylor, M.S.: Value creation and value capture: a multilevel perspective. *Acad. Manag. Rev.* **39**, 180–194 (2007)
22. Ple, L., Caceres, R.C.: Not always co-creation: introducing interactional co-destruction of value in service-dominant logic. *J. Serv. Mark.* **26**, 430–437 (2010)



Leadership Role Models for Young Professionals - Case Study from Finnish University Students

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Abstract. Leadership is a concept that is proven very hard to define unambiguously. Despite of this scientific gap, practical questions still are set towards leadership. Concept of leadership is widely used in other research and it is one of the most interesting research issues in organizations. Good leadership is like good quality; we can recognize it when we experience it, but it is quite hard to define where this feeling of good or bad quality came from. Data was gathered in 2015–2017 from students in Turku University of Applied Sciences. Students analyzed their former leaders with open answers. We employed a mix method design with both quantitative and qualitative analysis. For quantitative analysis, we employed automated content analysis based on Natural Language Processing (NLP) techniques. Results show that autocratic leadership is connected to negative picture of leader with in millennials Future research aspects and recommendations are issued in this paper.

Keywords: Leadership · Organizational behavior · Role · Management style · Natural language processing

1 Introduction

There are a many different approaches introduced towards leadership and leadership styles. The scientific leadership research history's beginning can be situated in era of management boom after Second World War, but it has been interest of humankind since the beginning of recorded history [1]. Alternatively, as Bass [2] states: "*Leadership is one the world's oldest preoccupations*". During the decades, different definitions for leadership is made over and over again and it is stated that "*there are almost as many definitions of leadership as there are persons who have attempted to define the concept*" [3]. Idea for wideness and the range of leadership field can be seen from e.g. review research executed by Dinh et al. [4] where they identified 66 different leadership theory domains. Naturally, it would be unfeasible to try to use all of these domains all the time or any time. Reunanen & Kaitonen [5] presented leadership styles' ontology where different approaches were combined to one holistic model and their similarities

were compared as an ontology. Authors’ (ibid) leadership style ontology is illustrated in Fig. 1.

	Kurt Lewin	Likert	Blake, Mouton & Reddin	Situational	LMX	Transformational	Multiple Linkage Model	Team leadership	Substitute for leadership	Goleman
Low	Authoritarian (autocratic)	Exploitive Authoritative	Task Concern	Directing (telling)	Stranger	Idealized influence and Inspiration	Task-Oriented	Some Relational high Task actions	No need for leadership	Commanding
Low	Democratic	Benevolent Authoritative	High Task Some Human Concern	Coaching (selling)	Acquaintance		Relations-Oriented	Task and Relational Actions	Need for leadership	Affiliative Visionary
High		Consultative	Some Task High Human Concern	Supporting (participating)		Intellectual Stimulation and Individualized Consideration	Change-Oriented	Some Task high Relational Actions		Democratic
Low	Laissez-Faire	Participative	Human Concern	Delegating (observing)	Mature partnership		External-Oriented	Environmental Actions	No need for leadership	Pacesetting Coaching
High										

Fig. 1. Leadership styles ontology [5]

The ontology illustrated in Fig. 1 consists behavioral approaches [6–9] later broadened by Yukl [10, 11] as well as latter additions by managerial grid thinking [12, 13] in behavioral approaches’ latter era. Since behavior theoretical models were found to be too simple to explain the completely complex concept of leadership, more integrative models were developed [10, 14]. Hence, situational leadership approaches [15–17] are integrated to model strengthened by situational interaction based theories [18, 19], recognizing that [19, 20] provided interesting add from leaders’ influence in followers’ satisfaction motivation and performance. Social interaction models are also handled from teams pursue to best solution together [21] and to the followers’ different positions in leaders mind as LMX theory sets them to in-group or out-group [14, 22]. LMX theory can be seen as one bridge between interaction and integrative leadership approaches. One of integrative approaches is transformational leadership [23, 2], which essence is to make leaders able to inspire followers to “produce far beyond what is expected of them”, and changes act as change agents by themselves. The multiple-linkage-model is Yukl’s [11] answer to the need for more integrative approach.

Both, transformational and multiple linkage approaches are quite heavily prone to development and positive change, some adding should be done regarding learning. Amy [24] found that emotionally intelligent communication was one of the most

prominent feature when facilitating learning in organizations, but authoritarian, defensive and non-communicative behaviors were not (positively) effective. Other well-known approaches include, matching people rightly to jobs, setting goals, but allowing enough freedom, support and encouragement from leaders, information sharing and openness [25]. One very characteristic integrative model is LAMPE approach and it consists former main issues enhanced by 29 leadership practices [26], but doesn't provide new style for the list. Team leadership model [14, 27, 28] is also included.

Substitutes for leadership [29] is an approach, which is also interesting, even that it is not directly a leadership approach. Approach has similarities to autocratic and *laissez-faire* styles. Authors (*ibid*) suggest that there are a number of characteristics, which may neutralize the need for leadership. Simplified, but very clear situations are that when follower has strong ability, and experience, need for independence or rewards are indifferent to him/her or follower's tasks are routine and clear or task provides intrinsic satisfaction or the organization is very inflexible or work groups are very cohesive. In these cases, there might be no need for task or relation leadership just e.g. standard operation procedures or good bonding and commitment from individuals towards work and organization (*ibid*). Emotional intelligence [30, 31] is one perspective in model, even that it is not exactly highlighted as a leadership approach.

Five common variables were found in model. Level of freedom for followers, how much they have freedom to make decisions by themselves i.e. framework for followers' decision making. (cf. Reunanen and Majjala [32]) Level of followers' capability, how capable followers are or how capable their leader thinks that they are. Which kind of orientation is kept by leader, or is needed to be kept, orientation to task or orientation to human. Complexity of the work is one common variable in ontology.

2 Research Setting

2.1 Research Data

First phase in this research was to gather information regarding experiences of leaders. This was done by task, which was appointed, to respondents. Their task was to analyze their experiences from work places, or if work experience was lacking, from hobbies or similar, where they had been led by leader. Respondents got short introduction lesson towards four distinctive leadership roles and how these roles might be recognized. After introduction class respondents got task that, they should analyze three different leader and leaders' styles from their past and place them under one of certain stereotypical role. These roles are more opened in next chapter. Respondents' task was to describe and analyze leaders with their own words and reason why they'd situate certain leader to certain stereotypical role according their leadership styles.

In this research leadership approaches/styles were chosen to handle as roles. For the sake of clarity, number of roles was diminished to four distinctively different ones: (1) "Like the others", (2) "Autocratic leader", (3) "Servant leader" and (4) "Leader who has in and out role in team". Like the others leader was chosen to represent archetype of leader who possesses the official management status but not charismatic leadership

status. There could be several reasons for this kind of style, e.g. person is not aware what leadership status means, person is unaware what are the responsibilities for management position or somebody in the team is not giving the charismatic leadership status for the person, to name a few. Autocratic leader is the leader whose style is very autocratic and who keeps long power distance to followers and utilizes “army style” leadership i.e. commanding, directive style. Servant leader is leader who puts the followers’ needs first and helping them to reach goals [33]. Servant leader builds an environment that serves the needs of the followers and enables them grow and develop, and encourages them to take new responsibilities [11, 34]. In introduction lesson servant leader was described as “mother hen” as its positive meaning. Leader who has role in and out of team is leader who has his/hers distinctive role as leader in the team/unit, but who is also considered as part of the team. Leader with in and out role possesses both, official management status and charismatic leader status and person recognizes that leader is organization’s representative in team.

The survey was executed among first and second year students from Turku University of Applied Sciences, Finland at 2015–2017. Students were 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, answers from 13 students was rejected from the study. Typically, in rejected cases, students were placing leaders to some classical styles such as Hersey and Blanchard or Blake and Mouton and were since incomparable with others. From these 150 students, who executed the task how it was meant, 450 cases were collected. From these cases, only autocratic leaders, 158 cases total, was selected to this research.

2.2 Research Questions

Main question was to find out whether there could be evidence found towards proposition that followers think that autocratic leadership is considered to be negative leadership style. When scrutinizing leadership styles’ ontology autocratic leadership is situated to be suitable only for people who are not used to be free or democratic in simple works with not very capable followers where tasks are more important than humans are. Therefore, hypothesis one was set as follows

H1. An autocrat leader is considered negatively in the eyes of followers.

This main research question was then analyzed via different negative aspects. Negativity of the autocrat leader implies that totality is clearly manifested, as in following hypotheses H2a–H2c.

H2a. The negative aspect of the autocrat leader positively affect Never (group of words implying ‘never’)

H2b. The negative aspect of the autocrat leader positively affect Everything (group of words implying ‘everything’)

H2c. The negative aspect of the autocrat leader positively affect Nobody (group of words implying ‘nobody’)

Feedback is and communication is often regarded as a positive aspect in leadership. Therefore, hypothesis H3 and H4 was conducted in to research questions.

H3. Leading the organization requires giving feedback

H4. Giving feedback affects a positive view from the subordinates.

3 Model Validation and Text Analysis

Structural Equation Modeling (SEM) was applied to test the model's goodness-of-fit [35–37]. 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 [38], the ratio CMIN/DF should be typically lower than 3. RMSEA should be .06 or smaller [39].

We employed a mix method design, a combination of strength, integrating qualitative and empirical analysis, and providing a better understanding of the research problem [40].

The organizations' top management continuously seeks to improve and optimize performance [41, 42]. Along with ongoing changes in the organization, its language changes, reflecting its changing characteristics. A thesaurus or semantic network reflects the language of the organization [43], however since language changes every day – thesauri require continuous investigation (Ibid).

We follow Eckhaus's [44, 45] methodology, employing a combination of N-gram and Bag of Words (Bow) techniques, for the analysis of leadership characteristics.

We employed TEXTIMUS, a text mining and analysis software [46]. First, n-gram frequencies were generated. N-gram refers to a contiguous sequence of n words from a given sequence of text [47]. N-gram is often used in sentiment analysis of texts [48].

Next, we made use of the BoW technique [49–51]. BoW is known as the most common method for the translation of text representation to numerical representation [52]. According to BoW, documents are represented as a collection of words, regardless of order. A group of keywords is then explored in the set of documents and assigned values 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 [53–57], the frequencies of each group were summed to the research variables, as follows. Leading – keywords that regard leading in the organization. Feedback-keywords implying giving feedback. Negative words. Positive words. Three groups of words that can be related to 'totality' characteristics: Never – words regarding the totality of 'at no time', Everything - words regarding the totality of everything and everybody, similarly for the group of words Nobody.

4 Results

The correlations, means, and standard deviation values between the research variables are presented in Table 1.

Table 1. Correlation matrix, means, and SD

	Leading	Feedback	Negative	Positive	Never	Everything	Nobody
Leading	-						
Feedback	.21**	-					
Negative	.02*	.17*	-				
Positive	.07	.24**	.24**	-			
Never	.05	.07	.18*	-.01	-		
Everything	.30***	.02	.37***	.11	.08	-	
Nobody	.08	.11	.39***	.04	.16	.17*	-
Mean	.77	2.39	12.16	2.73	.53	1.08	.75
SD	1.96	3.51	9.07	2.73	.98	1.29	1.0

* $p < .05$, ** $p < .01$, *** $p < .001$

Figure 2 illustrates the model and results. The hypothesized model showed a very good fit: CMIN/DF = 0.59 ($p > .05$), CFI = 1, TLI = 1.21, RMSEA = 0, NFI = 0.05. All hypotheses were supported. Leading positively affects Negative (H1).

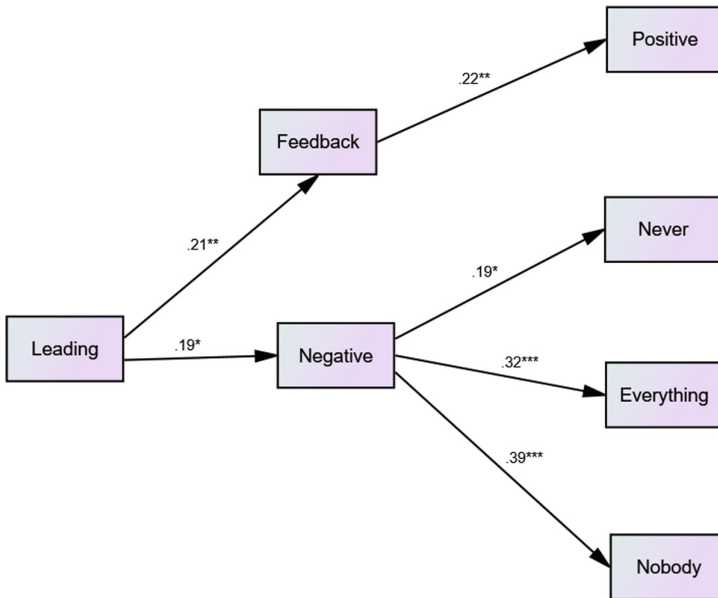


Fig. 2. Model results. * $p < .05$. ** $p < .01$. *** $p < .001$

The hypothesized model showed a good fit: CMIN/DF = 0.65 ($p > .05$), CFI = 1, TLI = 1.09, RMSEA = 0. All hypotheses were supported. Negative positively affect Never (H2a). Negative positively affect Everything (H2b). Negative positively affects Nobody (H2c). Leading positively affects Feedback (H3). Feedback positively affects Positive (H4).

Next, we added Gender as a controlled variable, in order to examine if any differences occur. The results still show a very good fit, CMIN/DF = 0.61 ($p > .05$), CFI = 1, TLI = 1.13, RMSEA = 0. All the relationships in from the previous model remain significant, however, Gender did not have any statistically significant relationship.

5 Discussion and Further Research

When looking the variety of different leadership approaches and theories it is quite clear that autocratic leadership style is recognized in majority of them. The question lies in the situation whether the autocratic leadership model is suitable or effective. As figured out in Reunanen and Kantonen [5] leadership styles ontology, it seems that work which is not demanding very capable followers, is task not human oriented and relatively simple this leadership style may become in the question. Results of this study are strengthening the picture that autocratic leadership is regarded to be negative and it is connected to negative words and words which are expressing totalities. This is quite understandable since autocratic leadership totalitarian approach from its nature, no or very limited freedom allowed. Feedback on the other hand was considered positive matter and it was connected clearly to the positive side of leadership.

There are significant limitations found in this research. Sample group is not representing the working life as and all workers even when the gender ratio was quite equal. Sample group consisted only young people born after between 1990 and 1998 i.e. they were representing generation y or millennials. Respondents represented university students in degree programs in which is quite hard to get in. Last, but not least, cultural homogeneity. Respondents were only from Finland, Nordic, rich, free and democratic country with long history of equal treatment between all people. What would have been the results if the respondents would have been twenty years older (differences between generation x and y), with very low education, from different, let's say, more masculine and power prone and not as free and equal culture.

On the other hand, this research draws a good picture that professional driven Nordic millennials are not thinking highly about autocratic leadership style. This is well parallel to former millennials researches. Martin [58] concluded that millennials interrogate. They want to know all about, what the organization demands from them, what are the career opportunities and rewards. They also demand immediate feedback. (ibid). Characteristic for millennials is that they want to take responsibility and prove themselves. They also prefer respect rather than money and have strong feeling for success [58–62]. They have crave towards occupation's meaning about the meaning. They can do work simultaneously at various fields [62, 63]. Millennials would like to work in organizations that are creative, innovative, energetic and environmentally friendly [60, 64]. When comparing these former research conclusions to results of this

paper, it could be clearly seen that commanding style authoritarian approach is not giving millennials the best possibility to gain working environment that they are expecting. It also is seen from former research that communication and feedback are highly respected and craved with millennials.

Future research is still needed. Autocratic leadership style is recognized, and yet still utilized even in highly developed and free country, as it can be seen from data of this research. When is autocratic leadership needed in order to enhance organizational performance, if at all? What would be difference between different respondent groups regarding autocratic leadership? Which kind of results would other stereotypical leader analysis provide?

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References

1. Drucker, P.: *Tasks, Responsibilities, Management, Practices*. Truman Talley Books E. P. Dutton, New York (1986)
2. Bass, B.M.: Two decades of research and development in transformational leadership. *Eur. J. Work. Organ. Psychol.* **8**(1), 9–32 (1999)
3. Stogdill, R.M.: *Handbook of Leadership: A Survey of the Literature*. Free Press, New York (1974)
4. Dinh, J.E., Lord, R.G., Gardner, W.L., Meuser, J.D., Liden, R.C., Hu, J.: Leadership theory and research in the new millennium: current theoretical trends and changing perspectives. *Leadersh. Quart.* **25**(1), 36–62 (2014)
5. Reunanen, T., Kaitonen, J.: Different roles in leadership styles in modern organization. In: *Advances in Intelligent Systems and Computing*, vol. 498, pp. 251–262. Springer, Cham (2016)
6. Lewin, K., Lippitt, R., White, R.K.: Patterns of aggressive behavior in experimentally created social climates. *J. Soc. Psychol.* **10**, 271–301 (1939)
7. White, J.H.R.: *Successful Supervision*. McGraw-Hill, London (1975)
8. Tannenbaum, R., Schmidt, W.H.: How to choose a leadership pattern. *Harvard Bus. Rev.* **51**, 162–180 (1973)
9. Likert, R.: *The Human Organization: Its Management and Value*. McGraw-Hill, New York (1967)
10. Yukl, G.A.: Managerial leadership: a review of theory and research. *J. Manag.* **15**(2), 251–289 (1989)
11. Yukl, G.A.: *Leadership in Organizations*, 8th edn. Pearson, Boston (2013)
12. Blake, R.R., Mouton, J.S.: *The Managerial Grid III: The Key to Leadership Excellence*. Gulf Publishing Co., Houston (1985)
13. Reddin, W.J.: *Managerial Effectiveness & Style: Individual or Situational*. McGraw-Hill, New York (1970)
14. Northouse, P.G.: *Leadership: Theory and Practice*, 5th edn. Sage, Thousand Oaks (2007)
15. Fiedler, F.: A contingency model of leadership effectiveness. In: *Advances in Experimental Social Psychology*, pp. 149–190. Academic Press, New York (1964)

16. Fiedler, F.: *Theory of Leadership Effectiveness*. McGraw-Hill, New York (1967)
17. Hersey, P., Blanchard, K.H., Johnson, D.E.: *Management of Organizational Behaviour. Leading Human Resources*. Prentice-Hall, Upper Saddle River (2001)
18. Evans, M.G.: The effect of supervisory behavior on the path-goal relationship. *Organ. Behav. Hum. Perform.* **5**, 277–298 (1970)
19. House, R.J.: A path-goal theory of leader effectiveness. *Adm. Sci. Q.* **16**, 321–339 (1971)
20. House, R.J., Mitchell, T.R.: Path-goal theory of leadership. *Contemp. Bus.* **3**, 81–98 (1974)
21. DuBouis, M., Hanlon, J., Koch, J., Nyatuga, B., Kerr, N.: Leadership styles of effective project managers: techniques and traits to lead high performance teams. *J. Econ. Dev. Manag. IT Financ. Mark.* **7**, 30–46 (2015)
22. Sherony, K.M., Green, S.G.: Relationships between co-workers, leader-member exchange, and work attitudes. *J. Appl. Psychol.* **87**, 542–558 (2002)
23. Bass, B.M., Avolio, B.J.: The implications of transactional and transformation leadership for individual, team, and organizational development. *Res. Organ. Change Dev.* **4**, 231–272 (1990)
24. Amy, A.H.: Leaders as facilitators of individual and organizational learning. *Leadersh. Organ. Dev. J.* **29**(3), 212–234 (2007)
25. Amabile, T.M.: How to kill creativity. *Harvard Bus. Rev.* **76**(5), 76–87 (1998)
26. Mackenzie, K.D.: The LAMPE theory of organizational leadership. In: Yammarino, F.J., Dansereau, F. (eds.) *Research in Multi-Level Issues: Multi-Level Issues in Social Systems*, vol. 5, pp. 345–428. Elsevier, Oxford (2006)
27. Zaccaro, S.J., Rittmana, A.L., Marks, M.A.: Team leadership. *Leadersh. Quart.* **12**, 451–483 (2001)
28. Day, D.V., Gronn, P., Salas, E.: Leadership capacity in teams. *Leadersh. Quart.* **15**, 857–880 (2004)
29. Kerr, S., Jermier, J.M.: Substitutes for leadership: their meaning and measurement. *Organ. Behav. Hum. Perform.* **22**(3), 375–403 (1978)
30. Goleman, D.: Leadership that gets results. *Harvard Bus. Rev.* **78**(2), 78–90 (2000)
31. Goleman, D.: What makes a leader? *Harvard Bus. Rev.* **82**(1), 82–91 (2004)
32. Reunanen, T., Maijala, R.: Management style, focus and purpose in development of LEAN in university hospital. 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)
33. Hunter, E.M., Neubert, M.J., Perry, S.J., Witt, L.A., Penney, L.M., Weinberger, E.: Servant leaders inspire servant followers: antecedents and outcomes for employees and the organization. *Leadersh. Quart.* **24**(2), 316–331 (2013)
34. Liden, R.C., Wayne, S.J., Zhao, H., Henderson, D.: Servant leadership: development of a multidimensional measure and multi-level assessment. *Leadersh. Quart.* **19**(2), 161–177 (2008)
35. Eckhaus, E.: Happiness in fashion. In: Kantola J., Barath T., Nazir S. (eds.) *Advances in Human Factors, Business Management and Society, AHFE 2018. Advances in Intelligent Systems and Computing*, vol. 783, pp. 15–25. Springer, Cham (2019)
36. Eckhaus, E., Sheaffer, Z.: Factors affecting willingness to contribute goods and services on social media. *Soc. Sci. J.* (2018). <https://doi.org/10.1016/j.soscij.2018.08.001>
37. Eckhaus, E., Sheaffer, Z.: Happiness enrichment and sustainable happiness. *Appl. Res. Qual. Life.* (2018). <https://doi.org/10.1007/s11482-018-9641-0>
38. 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 (2017). <https://doi.org/10.1016/j.ijchp.2017.02.003>

39. Hu, L.T., Bentler, P.M.: Cutoff criteria for fit indexes in covariance structure analysis: conventional criteria versus new alternatives. *Struct. Equ. Model. Multidiscip. J.* **6**(1), 1–55 (1999)
40. Tomas, J.R.: The effects of advertising alcohol on young people. *J. Soc. Sci. Humanit. Res.* **3** (1) (2017)
41. Eckhaus, E.: Barter trade exchange to the rescue of the tourism and travel industry. *J. Shipp. Ocean Eng.* **1**(2), 133–140 (2011)
42. Eckhaus, E., Kogan, K., Pearlman, Y.: Enhancing strategic supply decisions by estimating suppliers' marginal costs. *J. Supply Chain Manag.* **49**(4), 96–107 (2013)
43. Bedford, D.A.: Understanding and managing taxonomies as economic goods and services. *Bull. Assoc. Inf. Sci. Technol.* **40**(4), 15–22 (2014)
44. Eckhaus, E.: Corporate transformational leadership's effect on financial performance. *J. Leadersh. Account. Ethics* **13**(1), 90–102 (2016)
45. Eckhaus, E.: A shift in leadership. *Acad. Strat. Manag. J.* **16**(1), 19–31 (2017)
46. Eckhaus, E., Ben-Hador, B.: Gossip and gender differences: a content analysis approach. *J. Gend. Stud.* **28**(1), 97–108 (2017). <https://doi.org/10.1080/09589236.2017.1411789>
47. 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)
48. Nguyen, T.D., Nguyen, L.D.P., Cao, T.: Sentiment analysis on medical text using combination of machine learning and SO-CAL scoring. Paper presented at the 2017 21st Asia Pacific symposium on Intelligent and evolutionary systems (IES) (2017)
49. 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>
50. Eckhaus, E., Davidovitch, N.: Impact of gender and conference size on conference preferences – employing natural language processing. *Int. J. Educ. Methodol.* **4**(1), 45–52 (2018). <https://doi.org/10.12973/ijem.4.1.45>
51. Eckhaus, E., Davidovitch, N.: Improving academic conferences – criticism and suggestions utilizing natural language processing. *Eur. J. Educ. Res.* **7**(3), 445–450 (2018)
52. Roa, D.: Analysis of short text classification strategies using out of-domain vocabularies. (Master). KTH Royal Institute of Technology. Stockholm, Sweden (2018)
53. 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). <https://doi.org/10.1108/IJOTB-03-2018-004>
54. Eckhaus, E., Sheaffer, Z.: Managerial hubris detection: the case of Enron. *Risk Manag* **20**(4), 304–325 (2018). <https://doi.org/10.1057/s41283-018-0037-0>
55. 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)
56. 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)
57. Klein, G., Eckhaus, E.: Sensemaking and sensegiving as predicting organizational crisis. *Risk Manag.* **19**(3), 225–244 (2017). <https://doi.org/10.1057/s41283-017-0019-7>
58. Martin, C.A.: From high maintenance to high productivity. *Ind. Commer. Train.* **37**(1), 39–44 (2005)
59. Morton, L.P.: Targeting generation Y: segmenting publics. *Public Relat. Q.* **47**(2), 46–48 (2002)
60. Lowe, D., Levitt, K.J., Wilson, T.: Solutions for retaining generation Y employees in the workplace. *Bus. Renaiss. Q.* **3**, 43–57 (2008)

61. Gürsoy, D., Maier, T.A., Chi, C.G.: Generational differences: an examination of work values and generational gaps in the hospitality workforce. *Int. J. Hosp. Manag.* **27**(3), 448–458 (2008)
62. Eisner, S.P.: Managing generation Y. *SAM Adv. Manag. J.* **70**, 4–15 (2005)
63. Bennett, J., Pitt, M., Price, S.: Understanding the impact of generational issues in the workplace. *Facilities* **30**(7), 278–288 (2012)
64. Deloitte. The Deloitte Millennial Survey – Executive Summary. Deloitte. (2014) <https://www2.deloitte.com/content/dam/Deloitte/global/Documents/About-Deloitte/gx-dttl-2014-millennial-survey-report.pdf>



UDA-ERP: Theory, Development and Conflicts

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Abstract. Technology quickly advances and many times this produces a gap between technological advances that marks the industry and efforts that companies do for adopt them. Either it is not easy to know in depth the aspects that involve the development and management of an ERP, personally or in study centers, due to the large number of issues that be addressed, it is considered that the most appropriate approach to understand these is the parallel learning to the use and implementation of these tools. This work indicates the main aspects linked to an ERP system focusing mainly from the perspective of manufacturing. For reach it, a theoretical description of the key productive aspects involved in the development and implementation of an ERP system. It was possible by following the research process carried out by the “UDA - Universidad del Azuay” for the development of its UDA-ERP software, focused on being a product of attachment for the link with the community, mainly aimed at strengthening the MSMEs of Ecuador and the professional development of the university students.

Keywords: ERP · MRP · Systems engineering · Software engineering

1 Introduction

Production processes management, also known as Operations Management, is essential for the increase of productivity in organizations that generate goods and services worldwide. It is currently a key aspect for many companies that understand the importance to manage their human, material and financial resources, among others, in addition to the benefits that can be derived from these practices. The adoption of information technologies into business management processes allows streamlining the capture and the processing of data to convert it into information that allows top management to generate knowledge for decision making, synonymous with competitive advantage [1]. Several authors have indicated that information technologies (IT) have been a key support factor in different organizations for several years. In the last decade, there is no doubt that IT should be considered as a strategic factor, since IT

generates value for each unit or business department. Its management should not be seen as an unproductive cost or as part of a multi-service support department [2].

Operations management is one of the main axes of business development which, increased by information technology power, has allowed the development of one of the most widely used information management systems: The Enterprise Resource Planning (ERP). ERP software is known in the organizational context. It allows integrating a large number of functional areas that go from production, accounting and logistics to the management of clients and human resources. It catapults the cooperative work, it generates benefits for each one of the different departments of an organization; and, at the same time, achieves a holistic perspective of the entire company. Considered as the newest and most effective systems of business resource planning, it covers all organizational needs [3].

In this 21st century, focusing on clients' needs and their satisfaction through the generation of benefits under various administrative and quality approaches, is one of the main objectives that should guide the actions of a company, causing them to devote considerable efforts and resources to the company [4]. While this approach is still appropriate and valid today, a company must consider that this objective will be achievable only if the operations are focused and strategically aligned. This is where the strategy of implementing and using ERP systems becomes essential to achieve a common goal in each of the departments of an organization [5].

Adopting an ERP in the organization allows for: (i) reducing costs, (ii) simplifying the task of handling information, (iii) generating customer satisfaction; and (iv) manage the information generated by large amounts of data resulting from daily operations [6]. However, for a tool of this type to be completely successful, it is necessary that both the management and the users of the system have a clear understanding of how ERP systems handle processes, as well as having notions in the management of databases. Managing this data is a core part in the operation of ERP systems; which incurs high costs in its adoption and causes SMEs not implementing them.

The University of Azuay, as part of its commitment to the community, and respecting the strategic guidelines of the Republic of Ecuador in terms of improving the productive matrix, proposed in 2015 a project for the development of an ERP Software. This software tries to become a link with the entrepreneurs of micro, small and medium-sized Ecuadorian companies, to whom this solution is proposed.

The purpose of this paper is to review the theoretical aspects that should be considered in the development of an ERP software oriented to the predominant Ecuadorian business market: the family MSMEs. This article has five sections: (i) the state of the art; (ii) the applied research method; (iii) the results obtained; (iv) the discussion; and finally, (v) the most relevant conclusions.

2 Method

The method of this research started with the systematic literature review related to business processes related to the MSMe (Micro, small and medium enterprises) sector, information technology adoption plans, commercial goods proposes and their technical requirements, and interviews and surveys with business staff. In Ecuador, according to

the “Instituto Nacional de Estadísticas y Censos” (INEC): (i) the microenterprise is an entity with low income, composed of a number of employees equal to or less than 9 people, and whose annual turnover does not exceed 100,000 USD. (ii) The small company, an independent entity, has less than 50 employees and annual turnover of more than USD 100,000 but less than USD 1’100,000. (iii) The medium-sized company, characterized by the capital provided by its owners and a relatively small magnitude within the sector in which it operates, houses between 50 and 99 employees, and its turnover does not exceed \$2’000,000 [7, 8].

Consequently, in the second step, concepts were investigated related to: (i) the value of manufacturing requirement planning (MRP II) in organizations and how it generates benefits to clients as well a competitive advantage to the business. (ii) The functions and business processes, the functional areas of a company, the physical organization of production resources and the principles and types of manufacturing systems. (iii) The material requirements planning (MRP), the structure of the material planning system, the production route, the capacity management, the inventory management, the control and the production order closing. (iv) The double entry principle, the accounting components, the chart of accounts, the profit and loss statement, and the balance sheet. (v) The servuction (service production) theory and service processes, to which aspects of service environment that correlate the company, the client, and the service delivery processes are added.

In the third step, seven software solutions available in Ecuador were evaluated. They were selected by their commercial influence on the web. Quality aspects and suggested ISO 25000 evaluation processes were considered. Also, development properties, quality management, acquisition, adaptability, supplies and maintenance were appreciated.

In the fourth step, the organizational environment suggested by ISO 27005 and COBIT 5 were explored. To reach this goal, the first step (environment determination) of the third process (risk management) of the ECU@Risk methodology, which is a methodology for the management of informatics risks, was applied.

In the fifth step, the information requirements from each one of the main actors, who contribute to the value chain in a company of the manufacturing sector, were identified and analyzed.

Consequently, in the sixth step, aspects of current legal regulations that the software should consider were identified. For example, the provisions of the Ecuadorian Internal Revenue Service or the requirements to report information to the National Directorate of Public Data Registration (by its acronym DINARDAP).

Finally, in the seventh step, the ISO 25000 family was evaluated and the ISO 25023: 2016 standard related to the systems and software engineering that refers to the measurement of the product quality of the system and software (from the English Systems and software Quality Requirements and Evaluation - SQuaRE), was deepened. With this gathered information from the previous steps, the UDA-ERP software development plan was formulated.

3 Results

Any computer solution created in the academy, that seeks to establish a relationship of connection with the community and society must start from the theory. In 1958, Joe Orlicky developed and mint the concept of Material Requirements Planning, better known as MRP. Initially, this system focused on the assurance of the availability of materials and products for production and delivery to customers as well as maintaining adequate inventory levels for the operation; and the planning of manufacturing activities, delivery schedules and purchasing activities.

The primary objective of an MRP is to minimize the level of stock in warehouses through proper planning of production orders and the correct management of inventories. To achieve this goal, this system collects, primarily, information from three main sources: (i) the Master Production Schedule (MPS), which is a summary of the quantities that must be prepared for each order of finished product. (ii) The inventories, which refers to the number of units of a certain product existing in the warehouse and in the production process at a specific time. (iii) The material structure of each product or recipe of the product (Bill of Materials - BOM), which indicates the components that intervene in the manufacturing of each of the products that are listed in the Master Production Plan.

From these three aforementioned sources, different plans and reports were determined: (i) the production plan for each of the articles to be manufactured; (ii) the procurement plan that allows identifying and planning the order of material required for each order and their respective delivery dates; and (iii) reports of irregularities that summarize production orders that do not comply with the assigned schedule.

The ERP concept was born in the twilight of the decade of the 90s, where the need to expand the organizational approach for management operations that generate value to the client was born. This allowed to incorporate solutions for aspects of the administration of (i) relationships with the customer (CRM); (ii) supply chain (SCM); (iii) human resources (HRM); and (iv) financial and accounting resources [9].

3.1 Information Quality

Integrated information systems base their operation on large amounts of information, which is of value only if it is useful for the decision-making process. For a company or organization, information must meet the following characteristics: (i) clarity: the information must be clear and understandable to the decision-maker; (ii) validity: the information has a useful life time, (iii) relevance: the degree of importance of it for decision making; and (iv) accuracy: the information is complete and can be compared with reality. In order for the information system to be valid in the company, its management must consider the life cycle of the system to ensure its performance and that it is not affected over time [10].

3.2 Environment Identification

With what the ECU@Risk methodology [11] suggests, in addition to what Hirata proposes [12], the main problems related to the tasks that lead to the use of a new

system are: (i) lack of discipline; (ii) human error; and, (iii) lack of commitment among employees. These threats can cause the implementation of a computer solution to fail. In addition to these problems, there is the matter of technological development, the life cycle of the technology and the generic solutions that do not manage to adapt completely to the requirements of the organization.

3.3 Functional Business Areas

To understand the operation of an ERP system, one must first know the way in which a company is functionally organized and its functional areas. Table 1 shows the functional areas of a business, remembering that they are areas of a company in the MSME sector. In companies of a larger segment, other areas can be added.

Table 1. Organization functional areas

Functional areas	Purchases	Production	Accounting and finance	Sales	Human resources
Activities	Purchase of raw materials and supplies	Product design	Costs management	Management of sales orders	Hiring
	Reception of raw material	Manufacture of goods	Budgets	Advertising	Training
	Inventory control	Quality control	Audit	Customer service	Payroll management
	Replenishment	Capacity planning	Payments to suppliers	Sales forecast	Salaries
	Collections	Plant design		CRM	Payroll

In an organization, the interrelation of its functional areas starts with the delivery of products from a supplier so that later, after the manufacturing and production process, they are converted into finished goods, which are to be delivered to the final customer. This interrelation is explained in Fig. 1:

To improve operational efficiency in an organization, Henry Fayol mentions the importance of the division of labor in formal organizational structures. The productive elements, not necessarily human resources, also have their own organization and distribution to fulfill the assigned objective. Administratively, different departmental configurations are available. The physical distribution in a plant is nothing more than the physical disposition of the production resources that will be used for the production of goods and services. The most common configurations are: (i) product; (ii) process; (iii) group technology (cellular); and (iv) fixed position.

Many manufacturing facilities combine more than one type of configuration, since they are not dedicated solely to the elaboration of a specific product or part. Table 2 shows some of the advantages and disadvantages of each configuration.

Each mentioned alternative can be seen as the best option for a specific production environment, which can be easily summarized by the combination of product demand

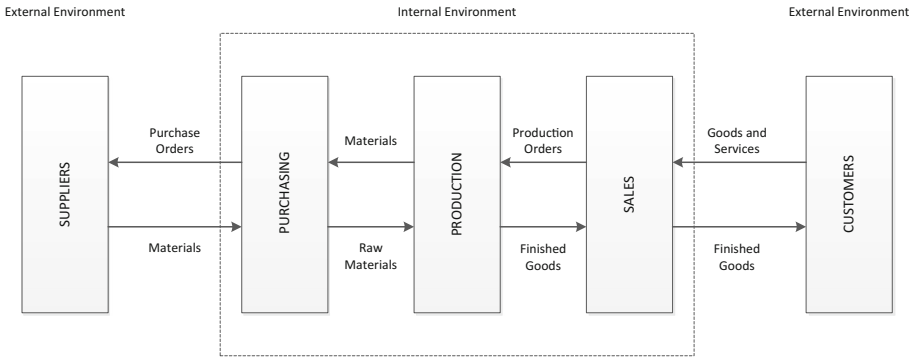


Fig. 1. Interrelation model of the functional areas of an organization.

Table 2. General characteristics of configuration types

Characteristic	Product	Process	Group	Fixed position
Processing time	Low	High	Low	Mid
WIP	Low	High	Low	Mid
Skill Level	Elective	High	Mid-High	Mid
Product flexibility	Low	High	Mid-High	High
Demand flexibility	Mid	High	Mid	Mid
Machine utilization	High	Mid-Low	Mid-High	Mid
Worker utilization	High	High	High	Mid
Unit production cost	Low	High	Low	High

volume and the variety of products or parts that can be manufactured. The configuration product offers the possibility of manufacturing large volumes but at the same time limits the variety of parts and pieces that can be manufactured. On the other hand, the process allows to manufacture a great variety of elements but in small volumes.

3.4 Manufacturing Systems

Manufacturing systems have 9 basic principles, but, according to Askin, they are not necessarily unique [13]. They are: (i) Little’s Law, which says that the work in process is directly proportional to the production rate and the flow time. (ii) The matter is conserved, that is, the production models must satisfy a balance equation in which the difference between the material that enters and that which leaves a workstation is equal to the accumulated inventory. (iii) The system is less reliable as its scope gets larger. The larger the system, the more difficult its design, maintenance and coordination. (iv) Objects decay, referring to obsolescence, both hardware and software. (v) The complexity grows exponentially, meaning that if a system has M components, each of which can be in an N state, the system can have MN states. (vi) The technological evolution which increases the efficiency of a plant and improves its performance.

(vii) The components in the systems seem to behave in a random way. This suggests that, because the world is stochastic and too complex to fully understand, events cannot be precisely predicted. (viii) limits of rationality (human). This refers to the limited cognitive capacity that human beings have; and finally, (ix) Combining, simplifying and eliminating saves time, money and energy, which suggests that every activity that takes place within a company will consume time, money and energy.

Manufacturing is based on two common concepts: (i) effectiveness, which refers to doing the right task; and (ii) efficiency, which refers to doing the task right. In practice, the ideal situation is that a planner is both efficient and effective, having sufficient capacity to determine the priorities within a company, and that at the time of executing them, they are performed correctly, considering the appropriate use of resources; that is, avoiding doing activities that do not generate value for the company [13].

3.5 Scenario Modeling

Modeling a scenario, for many, can be considered an art. The construction of the model implies a deep knowledge of the system which is to be modeled and a level of abstraction high enough to be able to include all the important variables involved, so that it resembles as much as possible to reality. Askin suggests [13] that it is better to have a simpler model but one that describes the system well enough, because they are easier to build, maintain and use.

Askin suggests that the variables and information used for modeling are appropriate, accurate, sufficient and timely. Verification and validation of the model has activities that overlap or are similar, being: (i) the comparison of the model and the structure of the system, a stage that suggests the verification of the relationship between the components of the system and its correct representation in the model. (ii) The comparison of the results and the corresponding information of the system, where it is verified if the analysis of the results gives information comparable to that of the operations of the system with similar quantities. (iii) The comparison of the model and the behavior of the system; where it is verified if the temporal behavior expressed by the model is comparable with the temporary behavior seen in the system in operation. (iv) the comparison of the structure of the model with the results of the structure and the results obtained from a similar model of the same system, are equal.

3.6 Material Requirement Planning

Material requirements planning is one of the main modules that make up an ERP and that are directly linked to manufacturing. The essence of manufacturing is the flow of materials from suppliers, through the plant, to customers and the flow of information to all parties involved. In addition, Ptak and Smith [14] suggest that a basic principle of manufacturing indicates that “all the benefits will be directly related to the speed of the flow of materials and information”, since time is the most precious resource in the process of manufacture and its last restriction.

The practice of predicting what is going to happen, based on historical information and waiting for the market to accept it, has ceased to be a reality in this computerized world according to Ptak and Smith [14]. The key questions for the planning and the

flexibility of the system are summarized in (i) How to minimize or eliminate the missing ones? (ii) How to keep production delivery times as short as possible? And, (iii) How to maintain the working capital (materials and manufacturing assets) synchronized with the demand? In addition, the aspect of variability and its way of controlling it must be considered. Systematically it can be minimized, but not eliminated; Ptak and Smith add that it takes time and investment to reduce it.

3.7 Material Planning System Structure

The stochastic nature of the world around us makes it very difficult to plan in certain occasions, a reality to which several industrial sectors are attached, especially in those where the demand or behavior of the industry is uncertain or very variable. The components of a planning process can be summarized in the Fig. 2 below:

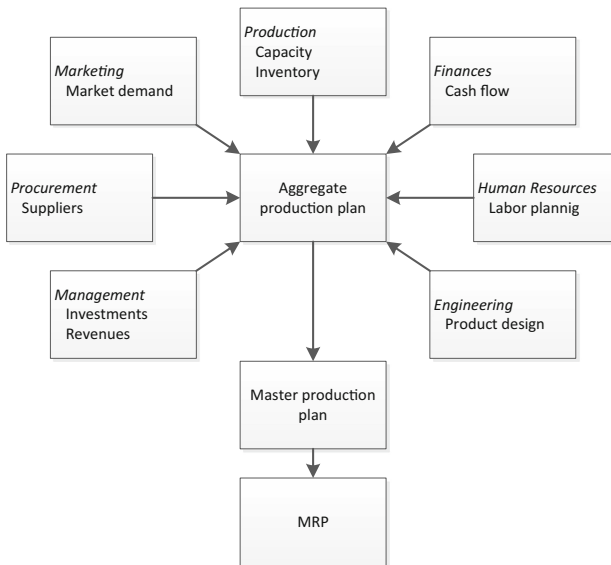


Fig. 2. Process planning components.

Aggregate planning is responsible for determining what should be produced and when to do it, usually between 3 and 18 months (medium term) ahead. It also focuses on reducing costs related to production while it is in the planning phase.

The production master plan is one of the main elements of the material requirement planning module, as it is a summary of the quantities that must be prepared for each product order, together with the delivery dates for each one of them. This plan disaggregates the information contained in the aggregate plan and establishes the quantities of products to be manufactured in specific terms of units of parts and pieces and no longer in a generic way.

The demand forecast is made up of customer orders and sales trends that are observed, considering that the forecast should be made by lines or families, not by items, because in this way variability is being added to the forecast [15].

One of the essential elements for disaggregating the information contained in the aggregate production plan; is the Bill of Materials -BOM- (the other is the inventory report). It allows knowing the components that intervene in the manufacturing of each of the products listed in the production plan. The list of materials can reflect the amount and form in which, each component is related. It can be said that the structure of the product is a list of materials, components and ingredients that allow identifying the relationships of dependency that exists between components.

3.8 Inventory Registry

The knowledge of the exact information contained in the inventory register is of utmost importance for the preparation of a production master plan. If you want an MRP system to work properly, good inventory management is not just a requirement, but an absolute necessity. The purpose of the inventory register is to keep track of inventory levels and properly manage replenishment needs and deadlines. According to Krajewski and Larry [16], the information by stages that appears in the inventory register consists of: (i) gross requirements; (ii) scheduled entries; (iii) projected inventory available; (iv) net needs; (v) planned order entries; and (vi) planned orders issues.

3.9 Capacity Management

The process of capacity planning is known as “Capacity Requirements Planning” (CRP), which according to the American Production and Inventory Control Society, has the function of establishing, measuring and adjusting limits or capacity levels. This context refers to the process of determining in detail the amount of labor and machinery resources necessary to carry out the production tasks. The purchase orders opened, and the orders planned in the MRP system are inputs for the CRP system. These orders are translated, through the use of production routes and time standards, into working hours by time period and work center. Although a first capacity planning indicates the existence of sufficient capacity to execute the production master plan, CRP shows that the capacity is insufficient during specific time periods.

As mentioned, when referring to aggregate planning, capacity planning has different time scopes. The dimension of time is very important when talking about capacity since it is not the same to plan for the long, medium or short term. Each period of time considers different resources and objectives, so it is necessary to make clear how you plan for these time scopes.

Similar to the MRP, CRP needs certain inputs that make it possible to calculate them. The necessary requirements are mentioned below. Units for the measurement of capacity, which allow to quantify the capacity, are generally expressed as a function of time, where the most common units are the “man hour” or the “machine hour”. The Production Route, already mentioned above, refers to the sequence that raw materials and other parts must follow to complete an article.

The Production Program used as input to CRP is a direct result of the MRP process. The released and planned orders are used to provide future visibility of capacity needs, and the production schedule that indicates the days on which a plant will work allowing realistic planning of delivery times.

3.10 Control and Closing of the Production Order

At ERP level, the control of the production order can be carried out by creating control points in specific places of the production process (production route). It may be of special interest for certain production managers to monitor the status of an order at some point in the production process. The objective of the control points is to verify the compliance with the specifications in critical points of the process and given the complex and expensive nature of certain activities, it is almost mandatory to perform this type of controls.

The closing of the order is carried out when the last activity of the production process has been completed and the order is entered into the warehouse as a finished product. In order for an order to be closed, all intermediate transactions involved in the production process must be completed. That is to say, the totality of the delivery-reception operations between the different work centers that take part in the manufacturing process must be completed, and the consumption of all the materials registered.

It is common for companies that handle ERP to make physically non-existent transactions to get out of trouble to start, maintain or close the production order. Two very common cases in which this situation occurs are: (i) entering raw material or finished product to the warehouse that has not yet been delivered or completed, in order to level inventory levels and thus make shipments of material or sales invoices of finished goods. (ii) complete delayed intermediate transactions that were not registered, transactions that become visible when trying to close an order and discover that the system sends alerts because the production flow has not been respected. Any of the two situations evidences a misuse of the ERP system and are the preamble of even greater problems. This shows that the company did not prepare adequately for the adoption of the system and also that the organizational culture is not the adequate one to adopt this type of technological solutions.

4 Discussion

Knowing that a model is nothing more than the simplified representation of a reality through the use of different media, the manufacturing one tries to represent in a summarized way the functioning of a productive system. Analytical models represent a more mathematical abstraction of reality, while experimental models try to imitate what happens in the real system. The models are built with many purposes, like (i) Optimization, searching for the best values for the decision variables; (ii) Predicting performance, checking potential plans and susceptibilities; (iii) Control, assist in the selection of control standards; (iv) Vision, provide better understanding of the system; and (v) Justification - help in sales decisions and as support for certain points of view.

Care must be taken when building models to test points of view, since there is a risk of ignoring important information that would lead to modeling failure. Therefore, the model must seek to discover the truth at all times, remembering that the model is a means and not an end. It is interesting to see how the existing synergy between the business structure, its human resources, policies and procedures, the management style can be improved through a computer system, which forms part of the business strategy to achieve shared values, according to the theory of the 7S of McKinsey.

Ptak and Smith [14] indicate that time and investment are required to decrease excess production, for the elimination of shortages and for market management. It is that living in a computerized world, where those who have the right information to make decisions at the exact moment, makes them outperform the competitor [11]. It is for this reason that relying on technology generates benefits for the organization and adds value to the client in accordance with the theory of the value chain proposed by its author, Dr. Michael Porter. The main inconveniences that affect the company, due to this type of situation, coinciding with Ptak and Smith, are: (i) Poor performance in deliveries compliance; (ii) extensive delivery times; (iii) oversupply of inventory; (iv) the investment recovery period is longer; (v) high number of complaints and claims by customers; and (vi) inadequate human relationship.

The net requirements should be calculated by subtracting the gross needs of the available inventory and the programmed entries. The purpose of planned order entries is to prevent inventories from ending up with negative values, as they become the amounts that must be entered into the system to meet the net needs of the period. In the preparation of the material requirements planning program, it should be considered that not all orders arrive at a company at the same time and that there may be orders that arrive at the beginning, middle or end of a period.

Achieving an efficient planning of the MRP so that the quantities and terms for the manufacturing of a certain product are clearly established does not mean anything if this planning cannot be carried out. Even if materials to manufacture a product are available, it is not possible to work with them if the proper capacity is not available [3].

According to Valentin Dumitru et al., the mutual evolution of organizations and systems, transform the case of the implementation of ERP into the best management and accounting practices in an emerging economy, an element that will be evaluated once the software is implemented in organizations [17].

5 Conclusions

Managing and understanding an ERP system is not an easy task, the elements involved in its development are numerous and complex, and they focus on different aspects of an organization. This work, which collects the main aspects of an ERP system from the perspective of MRP, compiles the main elements that must be taken into consideration in a productive process of any kind. Understanding the importance of each of these elements is vital for an organization to adapt its operations to the use of an ERP system. Not every organization, especially the MSMEs, possesses the information or expertise to develop the technical concepts mentioned in the development of this work. The contribution of educational institutions in this aspect is a contribution to the

development of the MSMEs sector and not only from the point of view of knowledge management but also from an economic perspective.

There are several software packages that currently manage ERP. However, due to a lack of knowledge from the potential users, their high costs and the complexity of their operation for MSMEs, it means that companies in this sector do not even consider their adoption. That is why the contribution made by the University to develop this software, means an important support to the MSME community, a circumstance that will allow companies in this sector to improve their production processes and therefore their competitiveness in the future, since they have an ERP software does not only mean owning or acquiring a computer package, it means preparing the organization for a new productive approach based specifically on planning and correct handling of information.

It is important to correctly understand the organizational business model as suggested by the ECU@Risk methodology, because in practice, successful implementation depends on the quality of information and the correctly established processes that the company has.

In the future, the ERP software developed by the University, will cover all the modules that are considered in its operation. This development leaves open any possible future research which allows to consider the critical aspects necessary for the correct development, use and implementation of each one of the modules.

References

1. Vásquez, F., Gabalán, J.: Información y ventaja competitiva. Coexistencia exitosa en las organizaciones de vanguardia. El profesional de la información, vol. 24, pp. 149–156. Ebsco (2015)
2. González, F.: El área de TI como generador de valor en el negocio. KPMG (2015)
3. Rahnavard, F., Bozorgkhoh, N.: Key factors in the successful implementation of enterprise resource planning system. *Manag. Sci. Lett.* 747–752 (2014)
4. Kotler, P., Gary, A.: *Marketing*. Pearson, México (2012)
5. Ragowsky, A., Somers, T.: Enterprise resource planning. *J. Manag. Inf. Syst.* **19**(1), 11–15 (2002)
6. Hussain, S.: Artist, Benefits and Challenges of Enterprise Resource Planning in Pakistani SMES. Turku School of Economics (2016)
7. INEC Directorio de empresas y establecimientos (2014). http://www.ecuadorencifras.gob.ec/documentos/web-inec/Estadísticas_Economicas/DirectorioEmpresas/Empresas_2014/Principales_Resultados_DIEE_2014.pdf
8. Ecuador en Cifras: Condiciones de vida de los ecuatorianos - Indicadores Sociales. INEC, Quito (2015)
9. Lupse, V., Cosma, O.: ERP extension - Supply Chain Management (SCM). *Informática económica*, pp. 120–124 (2006)
10. Shtub, A.: *Enterprise Resourcing Plannig (ERP), The Dynamics or Operations Management*. Kluwer Academic Publishers, Dordrecht (1999)
11. Crespo, E.: *ECU@Risk*, Cuenca, Azuay (2017)
12. Hirata, T.: *Customer Satisfaction Planning*. CRC Press, New York (2009)

13. Askin, R.G., Standridge, C.R.: *Modeling and Analysis of Manufacturing Systems*. Wiley, New York (1993)
14. Ptak, C.A., Smith C.: *Orlicky's Material Requirements Planning*. McGraw-Hill, New York (2011)
15. Ptak, C.A., Schragenheim E.: *ERP Tools, Techniques and Applications for Integrating the Supply Chain*. APICS Series (2000)
16. Krajewski, L., Larry, P.R.: *Administración de Operaciones, Estratégias y análisis*, Quinta ed. Pearson Education (2000)
17. Dumitru, V., Albu, N., Albu, C., Dumitru, M.: ERP implementation and organizational performance. A Romanian case study of best practices. *Amfiteatru Econ.* 518–531 (2013)

Human Factors, Business Management and Efficiency



The Effect of Macro Environmental and Firm-Level Factors on Open Innovations in Product Development and Their Impact on Firms' Performance

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Abstract. Most research on open innovation and product development concentrates on developing effective collaborative models to develop competitive products. Little research considers macro environmental and firm-level factors while developing such models. These factors can possibly affect outsourcing innovations in product development and later overall firm performance. As such, this research investigates how macro environmental and firm-level factors link with open innovations in product development and their relationship with the firm's overall performance. First, the conceptual framework of outsourcing innovations was synthesized from open innovation and business partnership related literature. A total of 60 intensive R&D-based firms were surveyed in 20 countries concerning the effects of macro environmental and firm-level factors on product development and its performance. Statistical techniques were used to analyse the data. The collected data helped to identify seven important macro environmental and firm-level factors. The results provided support for the conceptual framework and described the impact of all factors on developed product performance and the firm's overall performance in the given market. An implication for managers is that the provider's host country environment has no direct impact on a firm's performance.

Keywords: Innovations · Firm's performance · Contract research organizations · Outsourcing

1 Introduction

In the past, the first preference of every company has been to develop technologies in their own R&D units under strict control and later use them in the company's own product development [1]. As times have changed due to many factors in recent decades, companies have started to research technologies using more than their in-house resources [2]. It is becoming the norm that companies in nearly all industries are making collaborative contracts with external technology generators such as contract research organizations (CROs), technical universities and individual scientists and developers [3]. Companies working outside their R&D departments and technological

boundaries is referred to as open innovation (OI), a term first introduced by Henry Chesbrough, which means the development of innovations without any solid boundaries [4].

Open innovation seems like the simple term, but it encompasses various types of complex processes streamlined side by side while conducting technological collaborations [5]. As such, OI deals with both in-house and outsource technologies at the same time [6]. This means that technology developed by a firm can benefit another firm which does not have specialization in that specific technological segment in the industry [7]. Outsourcing innovations for developing new products mean that firms can look for external innovation providers which are suited to them, keeping in view some set guidelines such as similar company culture, previous relation with the provider and suitability for the given product development scenario [8]. Accordingly, it refers to the concept that in searching for such CROs, consideration of various firm-level factors can help to form a safe relationship, which will lead to innovations for product development [9].

Although there is research available which tackles the OI concept from many different angles, research still mostly revolves around the reshaping of in-house R&D [10]. Previous research has mainly focused on how to collaborate with external providers while keeping the company's own R&D capabilities fully intact [11]. However, in recent years CROs have captured huge shares of R&D business in all major industries and mother companies, in which they simply fund solutions that may even on occasion be unviable for in-house product development [12]. It appears that companies are doing so to gain a competitive advantage over their competitors in the given market but are ending up with compromised financial resources and technology leakages [13]. As a consequence, examining the overall macro environment while undergoing such collaborations is of great importance [14].

Some recent studies have highlighted the factors that play a vital role in the selection of innovation providers and warn of the need to review providers before entering into any binding OI [8]. However, these studies have focused on the specific factors and provide a one-sided picture, as the firm-level and macro environmental factors were not deeply discussed [14]. This research gap cannot be avoided as it affects the formation of a contract between two firms who want to work in an OI environment [15]. As mentioned previously, many firms are stuck with reference to the reasons for outsourcing and this determines their impact on firm's performance [16]. However, the firm-level and macro environmental factors are definitely one step ahead in such dealings [17]. Accordingly, the main research question driving this study is as follows:

“How do macro environmental and firm-level factors affect outsourcing innovations in the product development process and how are these factors related to firm performance?”

As such, eight major factors are included, namely; *miscellaneous reasons for outsourcing innovations altogether, protection of in-house R&D, arguments supporting outsourcing innovations, the reputation of CROs in the given market, collective pros and cons of outsourcing innovations, cost-effectiveness, speeding up new product development and the macro environmental and firm-level factors of the CRO host country*. This paper is divided into four parts. The first part highlights the literature related to OI, outsourcing innovations and their relationship with firms' overall

performance. This paper then discusses data collection methods, research instrument description, data analysis tools, research methodology and summary of findings. Finally, this paper explains the relationship between the macro environmental factors and firm-level factors affecting a firm's performance and discusses theoretical and managerial guidelines in addition to the limitations of the study.

2 Research Background

The Chesbrough concept of OI is defined as “a paradigm that assumes that firms can and should use external ideas as well as internal ideas, and internal and external paths to market, as the firms look to advance their technology” is the starting point for this study [4]. Product development in R&D departments is considered a backbone for all research processes which are now highly competitive in ever-growing innovative markets [18]. Once companies started to become saturated with their own in-house innovations and had nothing particularly innovative left to offer to the consumer on their own, they began to think out of the box [19]. Competition in the market on the other end has doubled even though innovative ideas have slowed down [20]. As such, at this stage companies are now stretching their reach in the market to find partners for the acquisition of knowledge and new ideas [21]. This is the point where companies have begun to collaborate out with their R&D boundaries and the concept of OI has kicked in.

While the innovation provider market was not that large in the beginning, as the concept became widely recognized in the market these CROs started to gain bigger shares of the market [22]. For instance, R&D service providers such as IBM, HP and Fujitsu respectively captured 56.2bn, 31.5bn and 29.6bn USD of the total R&D-based market of 226.1bn USD by 2012 [23]. Now companies are focusing on CROs as a major segment of their overall business. However, it is also the case that the involvement of any business in sharing R&D capabilities or intellectual property rights (IPRs) always represent a vulnerability for the firm's own R&D departments [24]. The companies which have handled this sharing of information successfully have grown quickly in the last decade compared to traditional firms which have been reluctant to do so [25].

This has led to discussions on how to conduct OI and outsourcing innovation business safely and grow. A few studies have highlighted that the factors involved in the selection of CROs are the first step to consider [8] while another study emphasized the high importance of evaluating the reasons for OI [16]. However, when firms enter general partnerships which do not involve the sharing of technologies, they always consider macro environmental and firm-level factors in business-to-business dealings [26]. As such, when firms begin to form R&D clusters it is also important to consider all such factors. It is also true that general business-to-business contracts differ to R&D sharing contracts [27], however the importance of evaluation and the impact of these factors cannot be denied. As such, the impact of macro environmental and firm-level factors such as the miscellaneous reasons for outsourcing innovations, the protection of in-house R&D, the supporting arguments for outsourcing innovations, the pros and cons of OI, the cost-effectiveness of the provider, speedy new product development

(NPD) and the innovation provider's host country environment/characteristics are an important part of the overall OI concept [17].

All of these factors have their own impact on the overall performance of a firm undergoing OI and partnering with CROs [28]. Previous research has studied the impact of these factors on firm performance at a general level [26], but if the firm is highly reliant for its business on OI settings it is impossible to determine the firm's performance without analysing its relationship with macro environmental and firm-level factors. The circumstances in OI change widely from case to case [25], so in alignment with the literature this study focuses on collective macro environmental and firm-level factors. These previous studies are considered a strong starting point for this study, which examines eight hypotheses covering firm performance and all factors discussed above.

3 Research Framework and Hypotheses

When firms decide to work in an OI environment this does not merely consist of two organizations simply sitting down and setting some guidelines for working together like any general business partnership. In reality, before entering into such partnership many macro environmental and firm-level factors need to be taken into consideration. These factors can later directly affect product performance and subsequently the firm's overall performance in the given market. So, as a simple rule, the higher the number of innovative products, the greater the chances of positive firm growth [29]. There can be hundreds of such factors depending upon the type of industry, but this study investigated eight major factors which are involved in similar OI contracts and their impact on a firm's overall performance.

H₁. Firm performance has been measured in the past based on various parameters and situations [20]. However, recent studies have not found any explicit relationship between a firm's performance and miscellaneous reasons for outsourcing innovations. A similar relationship discussed at a general level in the previous study highlights the different types of reasons [16].

Hypothesis 1: *There is a positive relationship between firm performance and miscellaneous reasons for outsourcing (R_o).*

H₂. It has been believed in the past that stronger boundaries with intact technology departments in growing firms are always the key for introducing innovative products and firm growth [18]. But today in the era of shared economy and technology, is it a traditional concept of growth still valid? However, it will always be important to have strict rules for IPRs [24].

Hypothesis 2: *There is a positive relationship between firm performance and protection of in-house R&D ($P_{R\&D}$).*

H₃. There has been quite a focus in the last decade on shared R&D houses and supporting their arguments to connect and develop together [30]. However, it is always important to note that supporting arguments for OI contracts always vary

substantially from case to case [11]. However, there is still common ground in these overall arguments [5].

Hypothesis 3: *There is a positive relationship between firm performance and supporting outsourcing arguments (S_{OA}).*

H₄. In the bigger picture of macro environmental factors for suitable OI partnership consideration should be given to the reputation, characteristics and viability for such bindings of the CRO [14]. In many cases, the evaluation of all these factors has helped companies to save a fortune [25]. Consequently, it is important to test the impact of these macro environmental factors on firms' overall performance.

Hypothesis 4: *There is a positive relationship between firm performance and CRO reputation/characteristics/viability in the overall outsourcing process (CRO_{Ch}).*

H₅. Many studies have identified the pros and cons of OIs based on various collaborative scenarios [31] and some have also connected them to a firm's performance at the individual level [16]. Based on previous studies it is assumed that there could be a positive relationship between the collective evaluation of the pros and cons of OI and firm performance.

Hypothesis 5: *There is a positive relationship between firm performance and the pros & cons of outsourcing innovations as a whole ($E_{P\&C}$).*

H₆. The literature highlights the importance of cost-effective manufacturing in many ways [8]. In the last two decades, all major companies have shifted their production plants to cheap manufacturing countries, predominantly China, India and Eastern Europe [32]. On the other hand, experiences concerning technology-based outsourcing relate to different scenarios. As such, it is important to assess the impact of cost-effective OI on firm performance.

Hypothesis 6: *There is a positive relationship between firm performance and cost-effectiveness as the main reason for outsourcing innovations (CE_{OI}).*

H₇. Previously, a single innovative product or service usually took a decade to be developed for consumer use. Especially in the case of pharmaceutical products, the introduction of which used to take 10 to 20 years [33]. However, due to increased market competition and more open collaborations, speedy product development has been realized [13]. Consequently, it is interesting to test firm performance against speedy product development as a firm-level and macro environmental factor.

Hypothesis 7: *There is a positive relationship between firm performance and speeding up the new product development process (S_{PD}).*

H₈. There are different approaches and laws related to R&D in developing countries and developed countries [26]. Similarly, there are different standard operating procedures and IPRs values in different regions [1]. All of these factors also collectively come under macro environmental factors. It will be helpful to check the impact of these factors on overall firm performance in the given market.

Hypothesis 8: *There is a positive relationship between firm performance and the country environment characteristics of the outsourcing provider/host/partner and their influence on the overall process ($OP_{Envir.}$).*

All hypotheses are represented in the following Fig. 1.

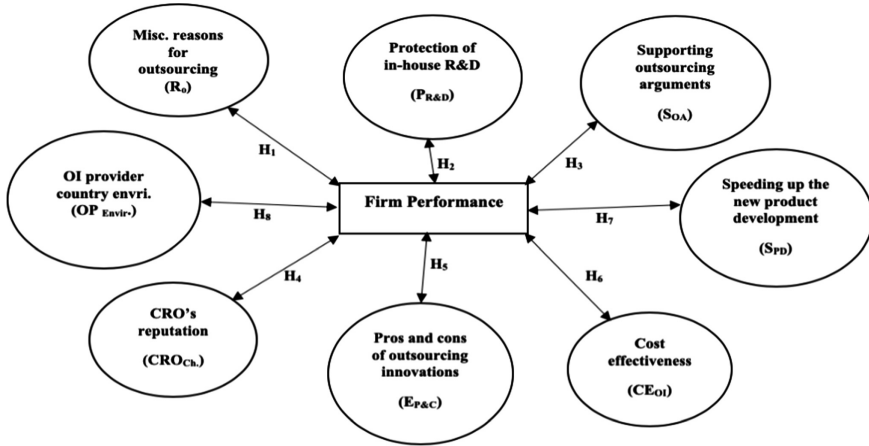


Fig. 1. Research framework and hypotheses

4 Methodology

The population sample for this project consisted of managers with solid experience in OI working environments and outbound technology acquisition. The participants in the projects were from 20 different countries around the world. Approximately 60 firms were involved in this study and it was conducted in 2016–2017. The unit of analysis was each individual professional. The sampling frame was randomly selected and included 260 individuals. The respondents were working in the countries such as Finland, Sweden, Denmark, Germany, Spain, the Netherlands, Switzerland, Cyprus, the USA, Canada, the UK, Singapore, Malaysia, Taiwan, India, Pakistan, the UAE, the KSA, Oman and Egypt. The firms were selected based on their inbound and outbound OI business orientation.

Specifically, industrial segments consisted of sectors such as the pharmaceutical industry (42%), the ICT industry (20%), life sciences (6%), engineering services (11%), financial services (6%), robotics (3%), logistics (3%), telecommunication (2%), the chemical industry (5%) and the automotive industry (2%). In addition to the online survey, 12 face-to-face interviews were also conducted for the validation of survey data and later results. Appointments were arranged by telephone and by official emails with a research participation invitation and privacy policy attached. Interviews and surveys were conducted by the corresponding author.

The final realized sample consisted of 112 usable questionnaires, which shows a 43% response rate. All surveys and interviews were organized and analysed. The participating firms also gave their approximate spending for inbound and outbound

OIs. When the outlays were compared separately with outbound and inbound OI-based products, the data showed that approximately 10.6% respondents believed that their in-house product performance was average, while 18.6% stated that the OI products performed better. On the other hand, approximately 8% of respondents said that their in-house innovative product performance was better than outsourced product performance in the given market.

The initial survey form was pretested with a convenience sample of 10 professionals who had been involved in OI related R&D activities. The pretesting was carried out using the participant pretesting method explained by Cooper and Schindler [34]. The collection of the data took approximately one year due to numerous reasons, with the most important being the spread ability of data in 20 countries and the sensitive information involved, which caused many managers to take longer to respond due to the need for permission from higher management about sharing the required information. Google forms and in some cases hard copies of surveys were used for the collection of data from respondents. No incentives were given to respondents to participate in the survey. All the data were confidentially handled according to EU privacy guidelines and the names of respondents or participating firms will not be revealed at any stage of the research except to those individuals which have been given permission. The questions in the survey were designed based on seven-point Likert scale statements. All the scale points of these questions were labelled ranging from one (strongly disagree) to seven (strongly agree).

The questions and optional answers were derived from the literature regarding the Chesbrough OI concept [4], outsourcing innovation and product development. Once the collected data were organized this helped to identify different variables which acted as different factors. These factors were later tested by statistical tools against firm performance. A similar research approach was adopted by Gunday et al. [35], but their research measured firm performance with respect to the innovativeness of the firm, while the current study measures firm performance against macro environmental and firm-level factors.

5 Analysis and Findings

The data was collected from 10 industrial segments as previously described with the help of a self-designed research instrument. Correlation analysis was performed using SPSS 24 to test the hypotheses. The data were collected from 10 industrial segments by self-designed surveys. Seven of the proposed hypotheses were validated by empirical analysis while only one hypothesis was not statistically significant. Table 1 illustrates the eight hypotheses (H_1 to H_8). H_1 claimed that firm performance is directly dependent on the miscellaneous reasons for outsourcing innovations (R_o) which is demonstrated by the statistically significant relationship ($p < 0.01$). Similarly, H_2 to H_7 proposed a direct relation between firm performance and the protection of in-house R&D ($P_{R\&D}$), the support of outsourcing arguments (S_{OA}), CRO's reputation ($CRO_{Ch.}$), the pros and cons of outsourcing innovations ($E_{P\&C}$), cost-effectiveness (CE_{OI}) and speeding up the new product development (S_{PD}). These hypotheses have been shown to have a significant relationship ($p < 0.01$, $p < 0.05$) through statistical analysis. However, H_8 was

not validated due to the non-significant relationship ($p > 0.01$) between firm performance and the outsourcing provider's country environment ($OP_{Envir.}$).

Table 1. Correlation analysis

Hypotheses	Factors	Correlation significance	p -value	Result
H ₁	Misc. reasons for outsourcing (R_o)	0.003**	$p < 0.01$	Supported
H ₂	Protection of in-house R&D ($P_{R\&D}$)	0.032*	$p < 0.05$	Supported
H ₃	Supporting outsourcing arguments (S_{OA})	0.000**	$p < 0.01$	Supported
H ₄	CRO's reputation ($CRO_{Ch.}$)	0.004**	$p < 0.01$	Supported
H ₅	Pros and cons of outsourcing innovations ($E_{P\&C}$)	0.004**	$p < 0.01$	Supported
H ₆	Cost-effectiveness (CE_{OI})	0.000**	$p < 0.01$	Supported
H ₇	Speeding up the new product development (S_{PD})	0.000**	$p < 0.01$	Supported
H ₈	OI provider's country envir. ($OP_{Envir.}$)	0.339	$p > 0.01$	Not supported

**Correlation is significant at 0.01 level

*Correlation is significant at 0.05 level

Table 1 illustrates the clear findings of the statistical analysis of the collected data conducted using SPSS 24. It shows that hypotheses H₁ to H₇ are supported while H₈ is not supported. The findings show that there is a positive impact on firm performance from the miscellaneous reasons for outsourcing innovations, the protection of in-house R&D, supporting outsourcing arguments, the CRO's reputation, the pros and cons of outsourcing innovations, cost-effectiveness and speeding up the new product development. However, the outsourcing innovation provider's country environment has no direct impact on a firm's performance.

6 Discussion and Conclusion

This paper focused on the potential relationship between firm performance and eight major macro environmental and firm-level factors which play important role in OI. To our best knowledge, it is the first project of its kind which studies such factors in an OI environment. The results indicate that firm performance is positively related to seven factors while it is not directly related to the outsourcing innovation provider's country environment. The identification of the positively related factors have validated some of the existing propositions in the literature [35] while the non-significant factor serves to update the general market assumptions related to OI [12].

The rejection of H₈ indicates a different perspective as it was believed that the suitability of the provider's country environment for the overall OI process has a huge impact [36]. However, this result breaks this general perception and shows that it has

no direct impact on a firm's overall performance in the given market. This can be explained by the views of experienced managers during the data collection, who mentioned that a country's overall environment is no longer particularly important because these days collaborative companies evaluate the contracts thoroughly and form strict standard operating procedures for the whole partnership in advance. The invalidity of H_8 illustrates the change in perspective of today's outsourcing innovation industry. Another angle to explain this lack of a relationship is that companies may have suffered in the past due to the provider's country business environment when they have ignored prior evaluations and the importance of safe outsourcing innovation contracts.

In general, the results of this study indicate that the miscellaneous reasons for outsourcing innovations, the protection of in-house R&D, the supporting arguments for outsourcing innovations, the pros and cons of OI, the cost-effectiveness of the provider and speedy NPD have a highly significant relationship with firm performance. In comparison to the one invalidated hypothesis described above, there were significant relationships with regard to the seven other hypotheses (H_1 – H_7) which showed the present attitude of managers and companies towards OI. Furthermore, the validation of these seven hypotheses is also a valuable contribution to the business-to-business research context, as it describes the important factors which can help to improve contracts between companies.

Consequently, the study also highlights the positive effects of the seven major macro environmental and firm-level factors on OI moderation between firms. In particular, the data have shown that protection of in-house R&D capabilities while conducting OI projects has positive effects on overall firm performance. In a similar way, cost-effectiveness in the technology market has a direct impact on firm performance and increases business for firms via OI. Due to market competitiveness, speedy product development is key to growth in the present era [13] and this study also showed its positive impact on firm performance. Miscellaneous reasons for outsourcing innovations cover the macro environmental and firm-level reasons as a whole and the significant relation of these reasons to firm performance in this study highlighted its important impact on OIs between involved firms. This finding provides further evidence for the importance of the evaluation of pre-contracts and motivating reasons before entering into the OI final bindings [21].

Additionally, this study placed a great deal of emphasis on the evaluation of pros and cons collectively. Although many previous studies identified the various pros and cons of OI-based contracts [31], analysis of the data of this study demonstrated a strong positive relationship between firm performance and the pros and cons of outsourcing innovations. Along with this relationship, supporting arguments for OIs dominate the recent literature [15] and this paper also showed the positive impact of OI arguments on a firm's overall performance. These findings support the conceptual framework and offer valuable insights for managers involved in outsourcing innovations. However, the establishment of seven positive relationships is not the final point for this research as it is necessary to study these factors for a longer period of time and in different scenarios to gain a deeper understanding.

7 Limitations and Direction of Future Research

Some limitations might be due to data collection and the interpretation of results. The first limitation might be the demographics of the selected data set. Every research study has implications and limitations associated with them. One potential loophole in the study was common method bias, because a single survey form was used for the collection of data from 10 different industrial segments. As such, the extent of the relationships between firm performance and influencing factors may be somewhat inflated. Moreover, while the sample was of an acceptable size, a larger sample would have provided more possibilities to use stronger statistical tools for analysis. Due to this limitation the study was unable to measure non-responsive bias.

Another potential limitation of the study is the focus on the product development side of R&D departments. Although all the personnel in R&D departments interact with each other in daily activities, this study mainly revolved around people specialized in OI and product development. As a consequence, the current study is unable to comment on the impact of other associated units in the R&D department on OI and overall firm performance.

References

1. Berchicci, L.: Towards an open R&D system: internal R&D investment, external knowledge acquisition and innovative performance. *Res. Policy* **42**(1), 117–127 (2013)
2. Vanhaverbeke, W.: External technology sourcing through alliances or acquisitions: an analysis of the application-specific integrated circuits industry. *Organ. Sci.* **13**(6), 601–740 (2002)
3. West, J., Salter, A., Vanhaverbeke, W., Chesbrough, H.: Open innovation: the next decade. *Res. Policy* **43**(5), 805–811 (2014)
4. Chesbrough, H.W.: *Open Innovation: The New Imperative for Creating and Profiting from Technology*. Harvard Business Review Press, Boston (2003)
5. Enkel, E., Gassmann, O., Chesbrough, H.: Open R&D and open innovation: exploring the phenomenon. *R&D Manag.* **39**(4), 311–316 (2009)
6. Almirall, E., Casadesus-Masanell, R.: Open versus closed innovation: a model of discovery and divergence. *Acad. Manag. Rev.* **35**(1) (2017)
7. Terwiesch, C., Xu, Y.: Innovation contests, open innovation, and multiagent problem solving. *Manag. Sci.* **54**(9), 1683 (2008)
8. Zafar, A., Kantola, J.: Relationship between firm's performance and factors involved in the selection of innovation providers. In: *Advances in Human Factors, Business Management and Society, AHFE 2018, Orlando, Florida, USA. Advances in Intelligent Systems and Computing*, pp. 194–205. Springer, Cham (2019)
9. Henkel, J., Schöberl, S., Alexy, O.: The emergence of openness: how and why firms adopt selective revealing in open innovation. *Res. Policy* **43**(5), 879–890 (2014)
10. Hossain, M.: Open innovation: so far and a way forward. *World J. Sci. Technol. Sustain. Dev.* **10**(1), 30–41 (2013)
11. Chesbrough, H., Kardon, A.: Beyond high tech: early adopters of open innovation in other industries. *R&D Manag. J.* **36**(3), 229–236 (2006)
12. van de Vrande, V., Jong, J.P., Vanhaverbeke, W., Rochemont, M.: Open innovation in SMEs: trends, motives and management challenges. *Technovation* **29**(6–7), 423–437 (2009)

13. Huizingh, E.K.: Open innovation: state of the art and future perspectives. *Technovation* **31** (1), 2–9 (2011)
14. Drew, S.A.: Building technology foresight: using scenarios to embrace innovation. *Eur. J. Innov. Manag.* **9**(3), 241–257 (2006)
15. Gassmann, O.: Opening up the innovation process: towards an agenda. *R&D Manag. J.* **36** (3), 223–228 (2006)
16. Zafar, A., Jussi, K.: Relationship between firms' performance and reasons for outsourcing innovation. In: *ISPIM Connects Fukuoka 2018*, Fukuoka (2018)
17. Cooke, P.: Regionally asymmetric knowledge capabilities and open innovation: exploring 'Globalisation 2'—a new model of industry organisation. *Res. Policy* **34**(8), 1128–1149 (2005)
18. Snow, C.C., Fjeldstad, O.D., Lettl, C., Miles, R.E.: Organizing continuous product development and commercialization: the collaborative community of firms model. *J. Prod. Innov. Manag.* **28**(1), 3–16 (2011)
19. Lichtenthaler, U.: Open innovation: past research, current debates, and future directions. *Acad. Manag.* **25**(1) (2017)
20. Alpan, L., Bulut, C., Gunday, G., Kilic, K., Ulusoy, G.: Organizational support for intrapreneurship and its interaction with human capital to enhance innovative performance. *Manag. Decis.* **48**(5), 732–755 (2010)
21. West, J., Bogers, M.: Leveraging external sources of innovation: a review of research on open innovation. *J. Prod. Innov. Manag.* **31**(4), 814–831 (2014)
22. Czarnitzki, D., Spielkamp, A.: Business services in Germany: bridges for innovation. *Serv. Ind. J.* **23**(2), 1–30 (2010)
23. List of top 10 service providers around the world. *Horses for sources*, Online (2013)
24. Henkel, J., Schöberl, S., Alexy, O.: The emergence of openness: how and why firms adopt selective revealing in open innovation. *Res. Policy* **43**(5), 879–890 (2014)
25. Rothaermel, F.T., Hitt, M.A., Jobe, L.A.: Balancing vertical integration and strategic outsourcing: effects on product portfolio, product success, and firm performance. *Strat. Manag. J.* **27**(11), 1033–1056 (2006)
26. Srinivas, K.M.: Globalization of business and the third world: challenge of expanding the mindsets. *J. Manag. Dev.* **14**(3), 26–49 (1995)
27. Okamuro, H.: Determinants of successful R&D cooperation in Japanese small businesses: the impact of organizational and contractual characteristics. *Res. Policy* **36**(10), 1529–1544 (2007)
28. Van Riel, A.C.R., Lemmink, J., Ouwersloot, H.: High-technology service innovation success: a decision-making perspective. *J. Prod. Innov. Manag.* **21**(5), 348–359 (2004)
29. 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. *Prod. Dev. Manag.* **27**(5), 725–740 (2010)
30. Houstan, L., Sakkap, N.: Connect and develop. *Harvard Bus. Rev.* **84**, 10 (2006)
31. Matthias Keupp, M., Gassmann, O.: Determinants and archetype users of open innovation. *R&D Manag.* **39**(4), 331–341 (2009)
32. Quinn, J.B.: Outsourcing innovation: the new engine of growth. *Sloan Manag. Rev.* **41**(4), 13 (2000)
33. Rothaermel, F.T., Deeds, D.L.: Exploration and exploitation alliances in biotechnology: a system of new product development. *Strat. Manag. J.* **25**(3), 201–221 (2004)
34. Cooper, D.R., Schindler, P.S.: *Business Research Methods*, International Edition. McGraw Hill, New York (2006)
35. Gunday, G., Ulusoy, G., Kilic, K., Alpan, L.: Effects of innovation types on firm performance. *Int. J. Prod. Econ.* **133**, 662–676 (2011)
36. Wan, W.P., Hoskisson, R.E.: Home country environments, corporate diversification strategies, and firm performance. *Acad. Manag. J.* **46**(1) (2017)



Four Conceptual Perspectives of Innovation Components

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Abstract. The study provides a detailed analysis of high impact to market innovations, without sorting whether these are innovations of low or high technological progress. The research base sample includes a detailed analysis of 58 consumer product innovations that reached a high market impact over the period 2014–2017, i.e. the consumers purchased them considerably more than other innovations. The study examines the components of these innovations in detail; they are also grouped into 4 basic groups. It is concluded in the study that the high impact to market innovations are made up of recurring 34 components. The study also concludes that the open innovation components only partly overlap with the innovation components that have been studied so far on the level of both micro and macro innovation eco-systems.

Keywords: Innovation classification · Innovation components · High impact to market innovations

1 Introduction

Strengthening innovation ecosystems is an important support for the creation of innovations in economies. As the researchers point out, the key determinant of their efficacy is the quality and quantity of entrepreneurship enabled innovation that unlocks and captures the pecuniary benefits of the science enterprise in the form of private, public, or hybrid goods [1]. In spite of significant investments in innovations and the large number of researches that thoroughly analyse innovation influencing factors, the amount of high impact to market innovations in industries varies between 3% and 16%, depending on the industry sector and the research organization counting them¹.

¹ Various sources of market research (OECD, Nielsen, Euromonitor International, MarketLine, etc.), depending on the type of industry, report different percentages of high impact to market innovations that become medium and long-term market participants. Depending on the source and industry size, in the studies available to the authors, this number varies between 3% and 14% of the total number of innovations released in the market within a given period.

It is a relatively small percentage related to the number of researches and the significant support provided both by the government, the companies and the academic environment to boost innovations.

The traditional academic model analysis, used in research, by government and most of industries, organizes the supportive structure for innovation creation based on deductive principle, prioritizing external influencing factors for innovation creation, interrelation and impact of processes [2]. A successful ecosystem of innovations - at both macro and micro level – is considered to be a driving force for the creation of innovations [3]. There are many studies that consider in detail the smallest steps and influencing factors in innovation creation process [4–7]. The creation of each innovation for a company is resource-intensive [8]. According to Forbes observations, in 2016, the average life expectancy of the top 500 most successful companies in the world decreased to an average of 15 years, compared to 75 in the middle of 20th century. It has a direct relation to the fact to which extent the innovations implemented by certain companies have been commercially successful in the market. According to Drucker, one of the founders of modern business management, one of the most important tasks for company managers is to understand what a company should not do as opposed to which priorities it should focus on [9], especially in terms such resource-intensive activities of companies as creating innovations. The aforementioned facts indicate that the number of innovations cannot be equalized to the quality of innovations, however, the number of innovations matches company's expenditures, of which, according to the aforementioned statistics, 84% to 97% are wasted resources both for the company and the support institutions that have supported these innovations.

Research Aim. The aim of the research is to find inductive relations that unite 3%–14% of high impact to market innovations. The task of the research is to analyse from inductive perspective those innovations that have achieved a significantly greater market impact than other innovations at the same time.

Research Methods. The narrowing of the research is product innovations, which have the greatest impact to market in monetary terms relative to other innovations. The commercially most successful innovations identified by the market research company Nielsen² in 2014–2017 in various regions of the world were taken as the base source of the sample. Innovation segmentation was based on the innovation classification approach proposed by Chan and Mauborgne [10], which distinguishes 2 innovation dimensions - technological progress and impact to market (Fig. 1).

² Nielsen is an international market research company specialised in the detailed monitoring of product sales results in retail trade. Every year, Nielsen compiles a list of the most commercially successful innovations in the world, identifying each year's most commercially successful innovations.

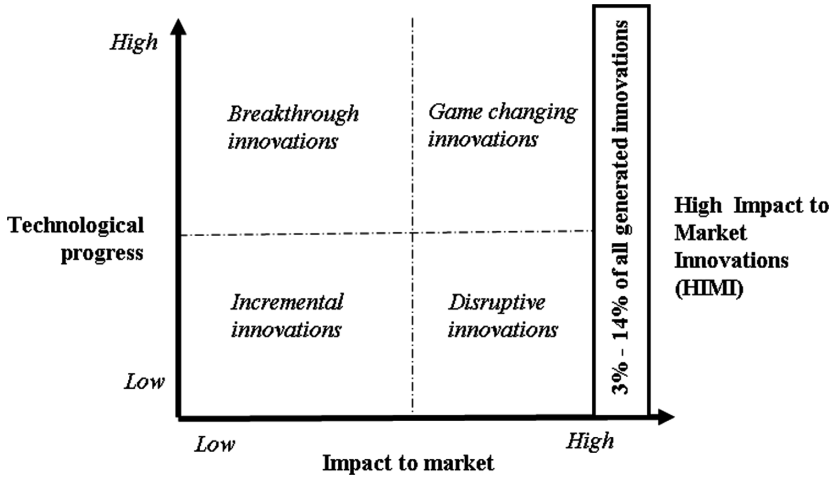


Fig. 1. Classification of innovations by their technological progress and impact to market, where the field of innovations analysed in the study, Hight Impact to Market Innovations (HIMI), is highlighted. Source: Graph composed by the authors, based on Kim and Mauborgne classification [10].

Content analysis method has been used for a detailed analysis of high impact to market innovations, hereinafter - HIMI, in order to make a systematic, quantitative processing, evaluation and interpretation of information form and content. Monographic document analysis method was used to conduct a detailed study based on extensive information review. Grouping method was used to form homogeneous groups based on the division of the scope of information into parts and/or merging of the study units into separate groups according to essential characteristics of the units.

The study was based on empirical content analyse of the 58 most market impactful innovations in time period from 2014–2017 according to base sample. HIMI were identified by the market research company Nielsen at time period 2014–2017. Besides current literature of innovation eco-systems and its compounding components were studied to link existing theory with actual market data.

2 Detailed Analysis of HIMI Components

2.1 Compliance of HIMI Components with Previous Studies

Initially, HIMI components were analysed and compared by TRIZ™ (Theory of the Resolution of Invention-Related Tasks) for 40 components, developed by G. Altshuller at the end of the 20th century, currently known as the most complete innovation component classification system [11]. However, HIMI corresponded to the TRIZ component classification only for about 1/3, with the rest of the authors concluding that a large part of components that make up innovation are not evaluated.

G. Altshuller approached a detailed study of innovations by examining patent database and identifying 40 invention constituting components, on the base of which

the TRIZ innovation system, which is currently used in applied research as well, was created. The sample, analysed by G. Altshuller, were registered patents. A patent itself as an innovation does not mean that the invention or innovation derivative it provides is demanded in the market [11]. It also explains the low level of HIMI components coincidence with TRIZ. The HIMI components were also compared to other innovation classifications described in the scientific literature, which have been developed in the following contexts:

1. TRIZ™ innovation classification [12]
2. Eco-innovation concept innovation classifications [13–17]
3. The lead user concept in the framework of user innovation concept classification [18–21]
4. User innovation concept classification [22]
5. Social innovation classification [23, 24]
6. Innovation intermediary concept classification [25, 26]
7. The Hypercube of Innovation classification [27]
8. Breakthrough innovations classification [28, 29]

As a result of a detailed investigation, using the methods indicated in the study, also amongst the innovation components suggested by these innovation approach concept classifications, only a fragmentary connection with HIMI inductive components, identified by in-depth analysis of HIMI, was found. As already mentioned, these innovation classification concepts primarily focus on the deductive classification of innovations.

2.2 HIMI Constituting Components and Their Definitions

As the result of a detailed HIMI analysis, 34 components that are specific to high impact to market innovations that have had a significant impact on the market have been identified. The components identified as the result of the study are considered in detail below. The components are content-intensive, thus an explanation – definition – is made for each component so that it can be classified and identified in other HIMI analyses (Table 1).

Table 1. Detailed description of high impact to market innovation (HIMI) component. Source: Table of definitions composed by the authors, based on empirical research.

Nb	Section ns	Innovation constituting components	Definition
<i>Innovation start position (market entry) components</i>			
1.	1.	The field of activity of the company that created the innovation	A company that has created and introduced to the market the innovation operates either internationally or locally/regionally
2.	2.	Size of the company that created the innovation	Belonging to small, medium (SME) or large enterprise status of company that has created and introduced innovation to the market

(continued)

Table 1. (continued)

Nb	Section ns	Innovation constituting components	Definition
3.	3.	Investing in science (R&D) of the company that created the innovation	Investments in science to date by the company that has created and introduced innovation to the market, measured in R&D expenditure. Classified up to or above the average in the region
4.	4.	Brand awareness of the company that created the innovation	Innovation belonging to a well-known brand or mother brand (umbrella brand) or an unfamiliar, little-known brand
5.	5.	Existence of advertisement	Presence or absence of the following visible integrated marketing communication campaign for innovation distribution in the market (integrated marketing communications)
6.	6.	Innovation market coverage	The scope of the market for innovation, classified in international distribution or within the local/regional market
<i>Fictional components of innovation</i>			
7.	1.	New scientific discovery	Innovation includes a new scientific discovery – invention, one of the functions of which involves technological progress
8.	2.	New product function	The new product contains a new feature that makes it an innovation
9.	3.	New substance	The new product is made up of new, innovative, undiscovered to date or unused in a certain product category substance component, which may be any consistency material, solid, liquid or gaseous, or a hybrid consistency of the mentioned substances. Applicable also if an already known substance is added in an innovative way that creates an innovative result
10.	4.	New content of a substance or material	The new product contains a novel component of the substance, which may be any consistency material, solid, liquid or gaseous, or a hybrid consistency of the mentioned substances. An unused, but known component of a substance can be added to a known material. The component of the substance itself may be not innovative, but in the material of a particular product, it is added for the first time and together with the base material forms an innovative composition

(continued)

Table 1. (continued)

Nb	Section ns	Innovation constituting components	Definition
11.	5.	New packaging	A new product is packed in a new, significantly different package that distinguishes it from similar, comparable products. Applies to both technical form and design solution
12.	6.	New product design (shape)	The new product contains a different form that is noticeably different from similar products
13.	7.	Health claim	The new product contains a claim that its functions will have a healthier effect on the body compared to similar products. The health claim is mentioned
14.	8.	More effective or less effective impact on the organism claim	The new product claims that its functions will act on the organism more effectively or less effectively in the spectrum of different claims compared to similar products
15.	9.	Premium pricing	The new product is at least 15% more expensive than a consumer equivalent
16.	10.	Combined functions	The new product combines several features that have been available in individual products to date
17.	11.	Enhanced or reduced effect	The new product claims that its features are enhanced or reduced compared to the previous version or an equivalent
18.	12.	Product size significantly reduced or increased	The new product size is significantly reduced or increased
<i>Innovation consumption components</i>			
19.	1.	New usage experience for the consumer	By using innovation, the consumer acquires a new, significantly different experience of use. The experience can be sensory, as well related to getting a new intellectual or emotional experience. For example, a new product fragrance, a new texture, a new use of an existing product, etc.
20.	2.	New skills, improved capabilities	By using innovation, the consumer acquires new skills, competences or knowledge. For example, acquiring a new smartphone, the consumer acquires new skills by using it

(continued)

Table 1. (continued)

Nb	Section ns	Innovation constituting components	Definition
21.	3.	New usage ritual	By using innovation, the consumer gets to know a new usage-consumption ritual that can be both functional and emotional. For example, a new ritual of enjoying a particular beverage by warming it up or a ritual to take some extra action using the product
22.	4.	Time saving	By using innovation, the consumer reduces time consumption to meet his or her functional or emotional need compared to another, alternative product. For example, breakfast in the form of biscuits, enjoying them on the road or fast cooking products
23.	5.	Consumption costs saving	By using innovation, the consumer reduces the cost to meet his or her functional or emotional need compared to another alternative product
24.	6.	Space saving	By using innovation, the consumer reduces the space necessary to meet his or her functional or emotional need compared to another alternative product
25.	7.	Consumption security improvement	By using innovation, the consumer obtains more functional or emotional security to meet his or her functional or emotional need compared to another alternative product
26.	8.	Reduction of household waste	By innovation, the consumer produces less household waste to meet his or her functional or emotional need compared to another alternative product
<i>Innovation mission (ideological) value components</i>			
27.	1.	Preservation/promotion of social values	References that emphasize fair-trade entrepreneurship, social entrepreneurship, the protection of human rights, the protection of minorities or other social values are used on innovation packaging or in brand communication
28.	2.	Preservation/promotion of individual values	References that emphasize individual's personal values, such as freedom, self-realization, personal growth, gender equality, feminism etc. are used on innovation packaging or in brand communication

(continued)

Table 1. (continued)

Nb	Section ns	Innovation constituting components	Definition
29.	3.	Preservation/promotion of nature values	Eco, organic, raw, white label, industrial waste reduction, CO2 emissions mitigation and other references on are used innovation packaging or in brand communication
30.	4.	Public health promotion	References that point to the impact of innovation in public health promotion at both general and individual levels on are used on innovation packaging or in brand communication
31.	5.	Preservation/promotion of cultural values	References that point to the impact of innovation in preservation and promotion of public cultural values are used on innovation packaging or in brand communication
32.	6.	Preservation/promotion of family values	References that point to the impact of innovation in preservation and promotion of family values are used on innovation packaging or in brand communication
33.	7.	Preservation/promotion of institutional values	References that point to the impact of innovation in preservation and promotion of certain institutional values are used on innovation packaging or in brand communication
34.	8.	Components supporting patriotic, religious, political values	References that point to the impact of innovation in preservation and promotion of some patriotic, religious and political values are used on innovation packaging or in brand communication

The listed 34 innovations are recurrent and interact within the framework of HIMI analysis. The average number of components load in HIMI is one third for one innovation in average. As the result of the study, HIMI components have been identified; however, there is a need for further research on HIMI to improve the list of existing components, which is currently an innovative approach to innovation classification.

2.3 The Basic Groups of HIMI Constituting Components

The identified HIMI components have been exposed to grouping method based on similar functions between the components. As the result of grouping method, they have been classified into four groups of HIMI constituting components.

- (1) The group of entry to market components of innovation of the company that creates an innovation, that is directly related to innovation and make its components. This is a very important group for of HIMI, as it enables to measure how many of HIMI are the innovations of large, international companies that have been given a significant support for integrated marketing communications, which have a major impact on the effect of innovations on market demand. The analysis of the portion of this group in the total number of HIMI will also provide for a more accurate identification of the role of marketing communications in the context of HIMI, which creates discourse in business environment.
- (2) The group of functional/technological process advantage innovation components, that measure the significance of functional advantage of a particular innovation compared to its similar analogues.
- (3) The group of consumption components of innovation and its comparative advantages compared to analogous products. This group measures the consumption/usability benefits of innovation to the consumer, which a particular innovation includes.
- (4) The group of mission (ideological) components of innovation that measures the benefits of the innovative ideological mission that a particular innovation includes.

The mentioned groups are classified in Fig. 2.

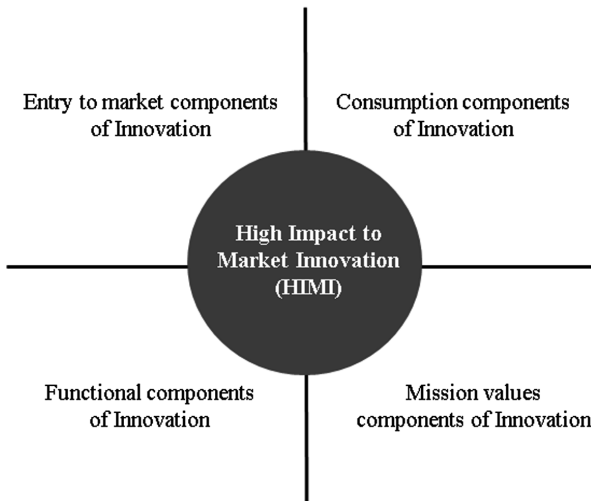


Fig. 2. High impact to market innovations (HIMI) components classification. Source: graph made by the authors, based on empirical research.

Each classification segment has a number of different components, among which no cross-linking was identified within this particular study. The identification and evaluation of such interactions and interrelations shall be the subject of further studies of the HIMI phenomenon.

3 HIMI Perspective in the Promotion of Innovation Ecosystems

Scientific technology is increasingly becoming a major source of competitive and sustainable benefits for both countries and regions. However, the quality and quantity of innovations generated by entrepreneurs is the determining factor of the effectiveness of scientific technology. For the economies that wish to develop a forward-looking perspective and vision by solving current problems and introducing the solutions of these problems, it is advisable to pursue innovation research in a holistic perspective, including, inter alia, a detailed assessment of the desired final result, HIMI. The massive focus in innovations on natural science-based technological progress has narrowed the viewpoint of innovation ecosystem support, with little coverage of the assessment of the initial capacity of innovation introducing to the market and the mission/ideological components of innovation. According to this study, high impact on market innovations contains a broader spectre of components, not limiting to functional and technological progress vector only. The current study outlines the next area of research required for further in-depth exploration of the HIMI segment in particular.

References

1. Carayannis, E.G., Campbell, D.F.J.: *Mode 3 Knowledge Production in Quadruple Helix Innovation Systems. 21st Century Democracy, Innovation, and Entrepreneurship for Development*. Springer, New York (2012)
2. Cooper, R.G., Edgett, S.J., Kleinschmidt, E.: *Portfolio Management for New Products*, 2nd edn. Perseus Publishing, Reading (1997)
3. Calantone, R., Garcia, R., Droge, C.: The effects of environmental turbulence on new product development strategy planning. *J. Prod. Innov. Manag.* **20**, 90–103 (2003)
4. Chandy, R.K., Tellis, G.J.: Organizing for radical product innovation: the overlooked role of willingness to cannibalize. *J. Mark. Res.* **35**, 474 (1998)
5. Cooper, R.G., Kleinschmidt, E.J.: New products: what separates winners from losers? *J. Prod. Innov. Manag.* **4**(3), 169–184 (1987)
6. Cooper, R.: Determinants of timeliness in product development. *J. Prod. Innov. Manag.* **11**, 381–396 (1994)
7. Danneels, E., Kleinschmidt, E.J.: Product innovativeness from the firms perspective: its dimensions and their relation with project selection and performance. *J. Prod. Innov. Manag.* **18**, 357–373 (2001)
8. Crawford, C.M.: The hidden costs of accelerated product development. *J. Prod. Innov. Manag.* **9**, 188–199 (1992)
9. Drucker, P.F.: *The Effective Executive: The Definitive Guide to Getting the Right Things Done*. Harper Business, an Imprint of HarperCollins Publishers, New York (2017)
10. Kim, W.C., Mauborgne, R.: *Value Innovation: The Strategic Logic of High Growth*. Harvard Business School Pub, Boston (2004)
11. Altshuller, G.S., Shulyak, L., Rodman, S., Clarke, D.W.: *40 Principles Extended Edition: TRIZ Keys to Technical Innovation*. Technical Innovation Centre, Worcester (2005)
12. Monnier: Application of the TRIZ method to business management activities. In: *TRIZ Future International Conference*, Florence, Italy, pp. 3–5 (2004)

13. Jones, E., Harrison, D., McLaren, J.: Managing creative eco-innovation—structuring outputs from eco-innovation projects. *J. Sustain. Prod. Des.* **1**, 27–39 (2001)
14. Rennings, K.: Redefining innovation—eco-innovation research and the contribution from ecological economics. *Ecol. Econ.* **32**, 319–332 (2000)
15. Cainelli, G., Mazzanti, M., Zoboli, R.: Complementarity in eco-innovation: concepts and empirical measurement. In: *The 16th Annual International Sustainable Development Research Conference 2010, Hong Kong*, pp. 1–33 (2010)
16. Rai, R., Allada, V.: Adaptive-Agent Based Simulation Model to Study Diffusion of Eco-Innovation Strategies. In: *28th Design Automation Conference*, vol. 2 (2002)
17. Beveridge, R., Guy, S.: The rise of the eco-preneur and the messy world of environmental innovation. *Local Environ.* **10**, 665–676 (2005)
18. Luthje, C., Herstatt, C.: The lead user method: an outline of empirical findings and issues for future research. *R&D Manag.* **34**, 553–568 (2004)
19. Lilien, G.L., Morrison, P.D., Searls, K., Sonnack, M., Hippel, E.V.: Performance assessment of the lead user idea-generation process for new product development. *Manag. Sci.* **48**, 1042–1059 (2002)
20. Intrachooto, S.: Lead users concept in building design: its applicability to member selection in technologically innovative projects. *TQM Mag.* **16**, 359–368 (2004)
21. Skiba, F., Herstatt, C.: Users as sources for radical service innovations: opportunities from collaboration with service lead users. *Int. J. Serv. Technol. Manag.* **12**, 317–337 (2009)
22. Hippel, E.V.: Role of lead users in innovation. In: *The Palgrave Encyclopedia of Strategic Management*, pp. 1–3 (2016)
23. Mumford, M.D., Moertl, P.: Cases of social innovation: lessons from two innovations in the 20th century. *Creat. Res. J.* **15**, 261–266 (2003)
24. Howaldt, J., Kopp, R.: Shaping social innovation by social research. In: *Challenge Social Innovation. Potentials for Business, Social Entrepreneurship, Welfare and Civil Society*, pp. 43–55 (2012)
25. Sieg, J.H., Wallin, M.W., Krogh, G.V.: Managerial challenges in open innovation: a study of innovation intermediation in the chemical industry. *R&D Manag.* **40**, 281–291 (2010)
26. Stewart, J., Hyysalo, S.: Intermediaries, users and social learning in technological innovation. *Int. J. Innov. Manag.* **12**, 295–325 (2008)
27. Afuah, A.N., Bahram, N.: The hypercube of innovation. *Res. Policy* **24**, 51–76 (1995)
28. 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 (2018)
29. Batraga, A., Salkovska, J., Braslina, L., Kalkis, H., Skiltere, D., Legzdina, A., Braslins, G.: Code of breakthrough innovations. In: *Advances in Intelligent Systems and Computing Intelligent Human Systems Integration 2019*, pp. 345–351 (2019)



Gossip and Pro Social Behavior

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Abstract. Volunteerism is pro-social behavior that positively affects both society and the volunteers themselves. Gossip is also a pro-social behavior, but usually perceived as negative. This research focuses on the effect of pro-social attitudes, age, and gossip on pro-social behavior, and specifically on the intention to volunteer.

A mixed method design was employed, combining manual and automated classification methods. Predicated on data elicited from 598 respondents, Exploratory Factor Analysis (EFA), followed by Confirmatory Factor Analysis (CFA) for convergent and discriminant validity were conducted. Path Analysis was used for goodness-of-fit analysis. The findings confirmed the hypotheses, suggesting that age, anti-gossip, and pro-social attitudes precede the intention to volunteer. Gossip was found to be perceived as negative despite its positive characteristics. This study represents an important attempt at determining the antecedents of the intention to volunteer as well as adding to our knowledge of gossip and refuting ageist stereotypes.

Keywords: Volunteer · Pro-social · Gossip · Age · Mix-method

1 Introduction

Social Capital is a theoretical concept that describes the benefits that derive from social connections [1]. These benefits are relevant for individuals and groups [2]. For individuals, Social Capital can lead to rewards such as information, power, and others sorts of capital such as financial [3]. It can also improve physical feelings and was proven as a reason for a longer and happier life [4]. Therefore, Social Capital is desirable and promotes individuals.

Both volunteering and gossip are components of Social Capital [5], i.e. social behaviors that can produce value to the individual and the group. Volunteerism was shown to improve individual life in many ways and contribute to society [6] by helping others [7].

Gossip is an informal means of communication, but also serves as an important form of social interaction [8]. In addition to delivering information, it provides a sense of social belonging and improves the individual's feeling. However, gossip has a negative reputation, especially with the general population [9]. Nevertheless, this may not be justified, and there is reason to subject this concept to a reconsideration [10].

In tracing the connections between these two concepts – gossip and intention to volunteer – we sought to determine if they underpin each other, as two components of

the same theoretical framework. Two other relevant variables were used – age and pro-social attitudes. We attempted to link these variables both to intention to volunteer and gossip. Age is important because research suggests the positive influence of social capital especially for the elderly. Nevertheless, there are many stereotypes and ageist assumptions surrounding the elderly and social capital [11]. It is therefore imperative to measure if elderly people volunteer and gossip to the same extent as younger individuals.

2 Theory

2.1 Intention to Volunteer and Pro-social Attitudes

Volunteerism is a prosocial behavior that is designed to help and benefit others [12]. It is an expression of core social principles such as solidarity, social cohesion, and democracy [2]. As Ajzen [13] and his followers proved, positive attitude on volunteerism is a predictor of volunteerism. However, researchers such as Janoski, Musick and Wilson [14] claim that volunteering behavior flows from general pro-social attitudes. They rely on findings that volunteers have more positive values than non-volunteers.

In this research, we evaluate the relationship between positive words regardless of context and volunteering intention. In a qualitative study among women living in poverty, Hilfinger Messias, De Jong and McLoughlin [15] found that women who volunteer tended to see good in and speak positively about others.

Brayko, Houmanfar and Ghezzi [16] used the Relational Frame Theory (RFT) to explain the connection between positive words used by people and volunteerism. This theory links verbal behavior (such as usage of positive words) and behavior. It posits that words are potential verbal reinforcers of intention to behavior. Therefore, using a positive word indicates that a person is experiencing a pro social attitude. These pro-social attitudes support pro-social deeds such as volunteerism; namely, intention to volunteer.

Relying on this research, we hypothesize that:

H1 - Pro-social attitudes positively affect the intention to volunteer.

2.2 Intention to Volunteer and Age

Ajzen [13] noted that perceived behavioral control is another condition for planned behavior. That is, people who apprise their capability to volunteer as high will have higher intentions to volunteer than people who apprise their capability to volunteer as low. Given that, it may be assumed that older people are more apt for volunteering because they are more mature and in possession of more free time.

In their research on the volunteerism of older adults, Wei, Donthu and Bernhardt [17] found that age was negatively connected with volunteerism. Moreover, many scholars linked volunteerism to young people [7]. However other [e.g. 18] yielded the opposite finding – the older the person, the higher the level of volunteering. For example, Stein [19] found that people between ages 25–59 tend to volunteer more than

younger people. Marta and Pozzi [20] found elevated volunteering intention among emerging adults.

H2 - Age positively affects the intention to volunteer.

2.3 Gossip and Pro-social Attitudes

Gossip is and has always been a very widespread human activity [21]. Gossip has many definitions; for example, an informal conversation that is typically evaluative [22] about an absent third person or persons [23]. Gossip is an important means of communication and has multiple functions in the social life of human beings such as acquiring knowledge about the social environment [24] and strengthening social relations [25]. Scholars distinguish between “good” and “bad” gossip [26]. Although the content of gossip can be positive [27] and the gossipers’ intentions can be good [28]; most studies of gossip found that people perceive it as negative and harmful [29]. Turner et al. [30] found that even if the content of the gossip is positive and the gossiper intentions are good, people still perceive gossip as evil. Thus, most people deny that they are gossiping [31], all the more so people with pro-social attitudes.

Therefore, it can be assumed that using positive word will be negatively connected to gossip. As such, it can be hypothesized:

H3 - Pro-social attitudes negatively affect gossip.

2.4 Age and Gossip

People gossip at almost all ages. McGuigan and Cubillo [32] found that boys and girls in ages 10–11 tend to gossip as part of their maturation process, accentuating social information. Schoon [33] found the same amount of gossip among adolescents as among adults, although the medium of gossiping was the mobile website. Even old people gossip Gamliel and Hazan [34] found that among elderly residents of old-age homes, gossip played an important role, they also found that the gossip role was primarily positive.

Gossip is an important means of communication, especially for young people who intensively monitor their social life. It is also a useful tool to determine belonging and establish in- and out-group norms [22]. However, there is a research gap on the connection between age and gossip. A scarcity of research exists on age gaps in male gossiping. Therefore, we may assume that eliciting feedback on gossiping about achievements through a questionnaire can provide us with information on both genders, since it was found that men as well as women engage in gossip on this subject [35]. Consequently, we hypothesize that:

H4 - Age negatively affects gossip.

2.5 Gossip and Intentions to Volunteer

Many studies support the positive value of gossip [36]. Some researchers noted that people who gossip are interested in others, care about them, and consequently talk about them [34]. Brown [37] mentioned the term ‘constructive gossip’ that can change negative attitudes towards unfortunate others. Volunteers are also people who are

interested in others and care about them [14]. Consequently, it maybe posited that people who gossip will have high intentions to volunteer. However, as was mentioned, gossip is generally perceived as negative in nature [38] and as unwanted behavior. Nevo et al. [39] found that social desirability and self-reporting about gossiping are inverse. Apparently, this is due to the perceived negative nature of gossip. Hence, it can be assumed that low gossipers will report high intention to volunteer in contrast to high gossipers.

Therefore, our last hypothesis is:

H5 – Gossip will be negatively connected to intention to volunteer.

3 Methodology

In order to assemble more and richer data on gossip and intentions to volunteer, we used both quantitative measures based on questionnaires as well as content analysis of open questions. Using a combination of these two research methods enhances the validity of the findings [40] by complementarity of strengths.

3.1 Initial Sample

A questionnaire was used for data collection, comprising both scale-based answered and two open questions. In total, 2230 completed questionnaires were collected. The questionnaire included four items, which relate to gossip on achievements. These derived from the tendency to gossip (TGQ) scale taken from Nevo *et al.* [39]. An open question asked respondents how they would describe someone they just met to a friend. Another open question elicited respondents to write freely about personal issues such as how they would want to spend their retirement, what their ideal career would look like, or anything else regarding themselves as well as additional demographics. Responses to the gossip items were on a Likert-type scale, ranging from 1 = “Never” to 5 = “Always”, which was narrowed from the 1–7 scale in Nevo *et al.* [39]. The questionnaires were distributed online using Google Docs by third-year undergraduate students to a diverse audience, including acquaintances, family, and co-workers.

3.2 Survey Analysis

Exploratory Factor Analysis (EFA) was performed, followed by Confirmatory Factor Analysis (CFA) for convergent and discriminant validity [41]. Path Analysis was used to test the model’s goodness-of-fit [42].

We employed CFI, NFI, RMSEA, and χ^2/df ratio, as reported fit indices. The accepted thresholds for these indices are: χ^2/df ratio should be <3 (Akbar and Parvez [70]), the values of CFI and NFI values > 0.90 (ibid), and $RMSEA \leq .06$ [43]. We used SPSS v.23 for EFA, and AMOS v.23 for CFA and Path Analysis.

3.3 Content Analysis

3.3.1 Manual Classification

In the first step, we manually reviewed all respondent texts of the personal open question and identified major themes. We then tagged each of these texts as belonging or not to the themes discerned – intention to volunteer and pro-social attitudes [44]. This process in which a document is assigned to a pre-existing category is called ‘text categorization’ and is a key area in text mining [45].

3.3.2 Automated Classification

In the age of globalization business processes are constantly changing and improving [46–48], along with learning skills [49] and the need to better understand and analyze data. We used TEXTIMUS, a software developed for supporting text mining and analysis [23, 50]. In the first module, we used generated n-gram frequencies [51, 52], referring to a contiguous sequence of n words from a given sequence of text. N-gram language models are state of the art in language analysis applications such as speech recognition, machine translation or character recognition. The second module counted the frequency of selected words from the set previously explored, including variations such as singular and plural forms, typo identifications, sensitivity to lowercase/uppercase, and identification of concatenated words.

First, we explored the frequency of words or phrases from all texts in the gossip open question. We selected a set of words that had the highest recurrence of at least 15 times among the set of respondents. From this set of words, we extracted a small set of words that appeared in the texts concerning positive action towards another person, both active and passive. For instance, the word ‘friend’ can be written as active (e.g. friendly) or passive (e.g. being a friend). However, the word ‘smart’ has nothing to do with an action towards another person. These selected words are *friend*, *helping*, *listen*, and *generous*. Then, we summed the number of appearances of each of these words for each respondent in this subset.

Next, we employed the ‘Bag-of-Words’ (BoW) technique [53, 54], which is the most common method for text analysis using natural language processing [55]. This technique is based on the concept that documents are represented as a collection of words, regardless of grammar and word order. According to this technique, a set of keywords is explored in all texts [56]. Each word is assigned a value indicating whether the word appears in a document or the number of times the word appears [57]. We, therefore, constructed the set of keywords as the variations of the four words previously extracted - *friend*, *helping*, *listen*, and *generous*. Different stems or tenses deriving from the same root (e.g., “help”, “helped”, “helping”) were treated as the same word. Similar to studies that employed BoW for determining individual characteristics [e.g. 58–60], we generated a variable (*QUAL*) that sums the occurrences of the four words in each of the texts. From the entire set, we selected only the texts that have at least one of the four words. Out of 598 respondents, 40.1% were males, and 59.9% females. Age range was 14–17 (2.9%), 18–24 (37.4%), 25–29 (29.5%), 30–39 (16.8%), 40–49 (6.4%), and 50+ (7.1%).

3.4 Exploratory Factor Analysis

From the TGQ questionnaire, we selected only the questions pertaining to achievements. After cross loading items were removed, several well-recognized criteria for the factorability of a correlation were used. Firstly, all items correlated at least .3 with at least one other item, suggesting reasonable factorability. Secondly, the Kaiser-Meyer-Olkin measure of sampling adequacy was .82, above the recommended value of .6 [61], and Bartlett’s test of sphericity was significant ($\chi^2(6) = 385.08, p < .001$). The diagonals of the anti-image correlation matrix were all over .5, supporting the inclusion of each item in the factor analysis. Finally, the loadings were all above .5 (Table 1), further confirming that each item shared some common variance with other items. Given these overall indicators, factor analysis was deemed to be suitable with the 4 items. A principal-components factor analysis of the 4 items using verimax rotations was conducted. Eigen values showed that each variable loaded onto one factor, explaining 52% of the variance.

Table 1. Factor loadings and based on a principal component’s analysis with verimax rotation for 4 items (N = 598)

Item #		GOS
6	Talk with friends about other people’s grades and achievements	.77
11	Talk with friends about educational level of celebrities	.75
13	Talk with friends about other people’s salaries	.74
7	Can contribute interesting information in conversations about people	.63

Note. Factor loadings < .5 are suppressed

3.5 Confirmatory Factor Analysis

Items of the gossip measure (GOS) were found to be loaded on one latent variable. Item loadings were 1, .99, .97, .68. CFA shows excellent fit to the observed data: $\chi^2/df = 0.14, p > .05, CFI = 1, NFI = 1, RMSEA = 0$.

Cronbach’s alpha examined internal consistency for the scale, showing adequate alphas of .70 for gossip (GOS). Pro-social attitudes are marked as (QUAL), intention to volunteer as (PRO), and age as (AGE).

4 Results

The hypothesized model showed an excellent fit: $\chi^2/df = 0.68, p > .05, CFI = 1, NFI = 0.98, RMSEA = 0$. All hypotheses were supported. Age positively affects the intention to volunteer (PRO) (H2) and negatively affects gossip (H4). Pro-social attitudes (QUAL) positively affect the intention to volunteer (PRO) (H1) and negatively affect gossip (H3). Finally, gossip negatively affects the intention to volunteer (PRO) (H5).

Since gender may impact gossip [23] and pro-social [62] tendencies, in the next stage, we extended the model to control for gender. The extended model also showed a good fit: $\chi^2/df = 1.35$, $p > .05$, CFI = 0.97, NFI = 0.92, RMSEA = 0.02. All hypotheses were supported. Consistent with the literature, Gender had an effect on GOS. However, Gender did not have a statistically significant effect on PRO.

5 Discussion

Using two different analytical methods, our results show that all research hypotheses were confirmed. The first hypothesis posited that pro-social attitudes positively affect intention to volunteer. That is, not only positive attitudes towards volunteerism affected intention to volunteer as Ajzen [13] predicted, but also general positive attitudes towards others. In our research, these were expressed in the freely written descriptions. Indeed, the notion that people who are positive towards others will be positive towards volunteering is unsurprising. The reality is that positive people will want to contribute to the welfare of others and make the world a better place.

The third hypothesis claims that pro-social attitudes negatively affect gossip. In other words, using positive words corresponds to declarations of avoiding gossip and holding negative attitude towards it. However, some research shows that gossipers are more pro-social than non-gossipers [23]. This is because people who gossip demonstrably care about other people; they spend time and attention talking about the behaviors, looks, or achievements of others. The fifth hypothesis also produced counter-intuitive results: Gossip was found to be negatively connected to intention to volunteer, which is a pro-social behavior intention. We deliberately examined gossip about achievements because it specifically reflects the gossip behavior of both genders as well as possessing positive characteristics that reinforce these findings.

Respondent disapproval of gossip can be attributed to the correspondence of pro-social attitudes with higher social desirability. That is, these individuals know that gossip is perceived as a negative quality and, therefore, express aversion towards it. Thus, the perception of gossip as an undesirable quality is reinforced and can be framed as widespread cognitive dissonance between behavior (gossiping) and attitudes (against gossiping). Unfortunately, breaking through this dissonance may result in harmful and negative outcomes – for gossipers and more generally. It is very difficult to stop gossiping, especially for those who care about others. The realization that one is indeed a gossip along with its negative connotations can cause self-hatred. Moreover, it can result in reputational damage to gossipers, as research has shown [29]. Gossiping is conventionally attached to many negative stereotypes such as hunger for power, evil intentions, and narrow-mindedness. Not only are these stereotypes unjustified, they can often provoke persecutions and inquisitions [63].

The second and the fourth hypotheses concerned the effects of age. The second posited that age will positively affect intention to volunteer. The fourth hypothesis claimed that age negatively affects gossip. Both hypotheses were confirmed such that older people tend to volunteer more and gossip less. In other words, older people tend to talk less and do more. Research indicates that volunteering gives meaning to life, especially for the elderly [64]. This is an important finding, contradicting commonly

held stereotypes of older people having less energy and engaging in high levels of gossiping. However, it should be noted that older people might exhibit many accumulated gossip stereotypes. They may, therefore, misrepresent their gossiping self-reports.

5.1 Limitations

As implied, self-reporting questionnaire, especially on gossip, may have limited generalizability. Gossip is a sensitive subject, and as such is affected by social stigma. This may generate a bias and pose a validity threat. We tried to overcome this problem by using only gossip on achievements in the questionnaire. As noted, this is perceived as more positive and legitimate by both genders. Moreover, de Reuver and Bouwman [65] found that older people tend to be less biased in self-reporting than younger people, so the validity threat is in actuality diminished.

Another limitation stems from dealing with intention to volunteer rather than with volunteering. The fact that people have intentions to volunteer does not automatically translate into actual volunteer behavior. We are not alone in confronting this limitation, with many scholars (such as [66]) investigating behavioral intentions. They tend to negotiate this problem by proving that intention to behave is the best predictor of behavior. Therefore, we suggest a follow-up study in which the connections in this study will be re-examined with a sample of volunteers.

We also referred to using positive words in open descriptions as entailing pro-social attitudes. Again, a gap may exist between self-reporting and genuine social attitudes. Perhaps the use of positive words is merely lip service. Some researchers claim that positive descriptions are used as a result of a “positivity bias” [67]. They also claim that this bias is very common in written expressions [68], and therefore using positive words and expressions does not really reflect exhibiting genuine pro-social attitudes. Nevertheless, analysis of open texts and close software-based examination of word choice may reflect reality more accurately than a self-reporting questionnaire, which may be more prone to biases.

5.2 Contributions

This research attempted to locate factors that affect intention to volunteer. It was found that pro-social attitudes and age exert a positive effect and that gossip negatively affect it. Tracing factors that impact the intention to volunteer is important, especially for organizations seeking to recruit volunteer. Many volunteering organizations experience difficulties in this domain. A deeper understanding of the intention to volunteer may help to upgrade and increase volunteer recruitment efforts. For example, focusing on candidate attitudes toward other people may help identify volunteers with more accuracy.

Moreover, the findings that older people tend to volunteer more than their younger counterparts and gossip less may serve as an effective rejoinder to the stereotype that this population is detrimental to the business sector. Unfortunately, ageism is a fairly widespread bias, even as our findings refute this stereotype and emphasize their contributions to society.

This research also contributes to theoretical work on gossip, addressing the research gap between gossip and a range of variables. A few studies have investigated the connection between gossip and age, and most were carried out only on women. In this work, both genders were evaluated. The results indicate that gossiping is perceived as undesirable behavior negatively connected to pro-social attitudes and intention to volunteer. This perception may result in unjustified stereotypes, especially towards positive gossip. Importantly, these stereotypes are often directed to more vulnerable populations such as women.

6 Summary

Volunteering is a significant activity in modern societies, both for the society and the volunteer. Therefore, tracing volunteering antecedences is important. Of course, there are many more reasons to volunteer [69], ranging from religious orientation to current lifestyle trends to personality characteristics.

This research is enhanced methodologically by matching questionnaires with written descriptions. As such, it represents a combination of qualitative and quantitative research methods. Our findings suggest that general pro-social attitudes and age are antecedences of intention to volunteer. We also found that older individuals, people with volunteering intentions, and people with prosocial attitudes tend to gossip less. These results refute stereotypes about older people, although strengthening stereotypes against gossipers.

References

1. Ben Hador, B.: Three levels of organizational social capital and their connection to performance. *J. Manag. Dev.* **36**, 348–360 (2017)
2. Putnam, R.D.: Bowling alone: America's declining social capital. *J. Democr.* **6**(1), 65–78 (1995)
3. Yu, C., Junshu, D.: A literature review of the effects of social capital – from the personal network perspective. *Int. J. Bus. Soc. Sci.* **4**(12), 251–259 (2013)
4. Shipley, M., Berry, H.L.: Longing to Belong: Personal Social Capital and Psychological Distress in an Australian Coastal Region. Social Science Research Network, Rochester (2010)
5. Beilmann, M., Realo, A.: Individualism-collectivism and social capital at the individual level. *Trames: J. Humanit. Soc. Sci.* **16**(3), 205–217 (2012)
6. Benson, A.M., Dickson, T.J., Terwiel, F.A., Blackman, D.A.: Training of Vancouver 2010 volunteers: a legacy opportunity? *Contemp. Soc. Sci. J. Acad. Soc. Sci.* **9**(2), 210–226 (2014)
7. Pantea, M.: Young people in cross-national volunteering: perceptions of unfairness. *J. Soc. Pers. Relat.* **30**(5), 564–581 (2013)
8. Baxter, L.A., Dun, T., Sahlstein, E.: Rules for relating communicated among social network members. *J. Soc. Pers. Relat.* **18**(2), 173–199 (2001)

9. Peters, K., Kashima, Y.: Gossiping as moral social action: a functionalist account of gossip perceptions. In: Laszlo, J., Forgas, J., Vincze, O. (eds.) *Social Cognition and Communication*. Psychology Press, New York (2013)
10. Miller, D.E.: "Snakes in the greens" and rumor in the innercity. *Soc. Sci. J.* **29**(4), 381 (1992)
11. Gilleard, C., Higgs, P.: Social death and the moral identity of the fourth age. *Contemp. Soc. Sci.* **10**(3), 262 (2015)
12. Batson, C.D., Powell, A.: Altruism and prosocial behavior. In: Millon, T., Lerner, M. (eds.) *Handbook of psychology. Personality and Social Psychology*, vol. 5. Wiley, Hoboken (2003)
13. Ajzen, I.: The theory of planned behavior: some unresolved issues. *Organ. Behav. Hum. Decis. Process.* **50**, 179–211 (1991)
14. Janoski, T., Musick, M., Wilson, J.: Being volunteered? The impact of social participation and pro-social attitudes on volunteering. *Sociol. Forum* **13**(3), 495–519 (1998)
15. Hilfinger Messias, D.K., De Jong, M.K., McLoughlin, K.: Being involved and making a difference: empowerment and well-being among women living in poverty. *J. Holist. Nurs.* **23**(1), 66–88 (2005)
16. Brayko, C.A., Houtmanfar, R.A., Ghezzi, E.L.: Organized cooperation: a behavioral perspective on volunteerism. *Behav. Soc. Issues* **25**, 77–98 (2016)
17. Wei, Y., Donthu, N., Bernhardt, K.L.: Volunteerism of older adults in the United States. *Int. Rev. Public Non-Profit Mark.* **9**(1), 1–18 (2012)
18. Tang, F.: What resources are needed for volunteerism? A life course perspective. *J. Appl. Gerontol.* **25**(5), 375–390 (2006)
19. Stein, D.D.: What motivates people to volunteer? A survey research study to analyze characteristics and motives of individuals that donate time. A dissertation, Capella University, Minneapolis, MN, USA (2011)
20. Marta, E., Pozzi, M.: Young people and volunteerism: a model of sustained volunteerism during the transition to adulthood. *J. Adult Dev.* **15**, 35–46 (2008)
21. Massar, K., Buunk, A.P., Rempt, S.: Age differences in women's tendency to gossip are mediated by their mate value. *Pers. Individ. Differ.* **52**(1), 106–109 (2012)
22. Subramanian, M.: Gossip, drama, and technology: how south Asian American young women negotiate gender on and offline. *Gen. Educ.* **25**(3), 311–324 (2013)
23. Eckhaus, E., Ben-Hador, B.: Gossip and gender differences: a content analysis approach. *J. Gen. Stud.* **28**(1), 97–108 (2017). <https://doi.org/10.1080/09589236.2017.1411789>
24. Bergmann, J.R.: *Discreet Indiscretions: The Social Organization of Gossip* (J. Bednarz, Trans.). Aldine De Gruyter (Original work published 1987), New York (1993)
25. Michelson, G., Mouly, V.S.: Rumor and gossip in organisations: a conceptual study. *Manag. Decis.* **38**, 339–346 (2000)
26. Kurland, N.B., Pelled, L.H.: Passing the word: toward a model of gossip and power in the workplace. *Acad. Manag. Rev.* **25**(2), 428–438 (2000)
27. Luna, A., Chou, S.Y.: Drivers for workplace gossip: an application of the theory of planned behavior. *J. Organ. Cult. Commun. Confl.* **17**(1), 115–129 (2013)
28. Jackson, C.: Using gossip constructively as a part of holistic process. *Holist. Nurs. Pract.* **26**, 183–187 (2012)
29. Einat, T., Chen, G.: Gossip in a maximum security female prison: an exploratory study. *Women Crim. Justice* **22**(2), 108 (2012)
30. Turner, M.M., Mazur, M.A., Wendel, N., Winslow, R.: Relational ruin or social glue? The joint effect of relationship type and gossip valence on liking, trust, and expertise. *Commun. Monogr.* **70**(2), 129–141 (2003)

31. Hartung, F., Renner, B.: Social curiosity and gossip: related but different drives of social functioning. *PLoS One* **8**(7), 1–10, e69996 (2013)
32. McGuigan, N., Cubillo, M.: Information transmission in young children: when social information is more important than nonsocial information. *J. Genet. Psychol.* **174**(6), 605 (2013)
33. Schoon, A.: Dragging young people down the drain: the mobile phone, gossip mobile website outlet and the creation of a mobile ghetto. *Crit. Arts* **26**(5), 690–706 (2012)
34. Gamliel, T., Hazan, H.: The meaning of stigma: identity construction in two old-age institutions. *Ageing Soc.* **26**(3), 355–371 (2006)
35. Watson, D.C.: Gender differences in gossip and friendship. *Sex Roles* **67**(9–10), 494–502 (2012)
36. Waddington, K., Fletcher, C.: Gossip and emotion in nursing and health-care organizations. *J. Health Organ. Manag.* **19**, 378–394 (2005)
37. Brown, G.W.: Joining two social institutions to counter rural Alaskan child abuse. *Child Abuse Negl.* **9**(3), 383–388 (1985)
38. Blank, S.: The metaphorical prison: gossip, sex, and single mothers in dominica. *Wadabagei: A J. Caribb. Diaspora* **13**(1), 62–86 (2010)
39. Nevo, O., Nevo, B., Derech-Zehavi, A.: The development of the tendency to gossip questionnaire: construct and concurrent validation for a sample of Israeli college students. *Educ. Psychol. Measur.* **53**(4), 973–981 (1993)
40. Dellinger, A.B., Leech, N.L.: Toward a unified validation framework in mixed methods research. *J. Mix. Methods Res.* **1**(4), 309–332 (2007)
41. Eckhaus, E., Sheaffer, Z.: Factors affecting willingness to contribute goods and services on social media. *Soc. Sci. J.* (2018)
42. Eckhaus, E., Davidovitch, N.: Impact of gender and conference size on conference preferences – employing natural language processing. *Int. J. Educ. Methodol.* **4**(1), 45–52 (2018). <https://doi.org/10.12973/ijem.4.1.45>
43. Hu, L.T., Bentler, P.M.: Cutoff criteria for fit indexes in covariance structure analysis: conventional criteria versus new alternatives. *Struct. Equ. Model. Multidiscip. J.* **6**(1), 1–55 (1999)
44. Eckhaus, E., Sheaffer, Z.: Happiness enrichment and sustainable happiness. *Appl. Res. Qual. Life* (2018). <https://doi.org/10.1007/s11482-018-9641-0>
45. Pushpa, M., Nirmala, K.: Text categorization using activation based term set. *Int. J. Comput. Sci. Issues (IJCSI)* **9**(4), 397–400 (2012)
46. Eckhaus, E.: Barter trade exchange to the rescue of the tourism and travel industry. *J. Shipp. Ocean Eng.* **1**(2), 133–140 (2011)
47. Eckhaus, E.: Towards tourism business change. *Rev. Int. Comp. Manag.* **18**(3), 274–286 (2017)
48. Eckhaus, E., Kogan, K., Pearlman, Y.: Enhancing strategic supply decisions by estimating suppliers' marginal costs. *J. Supply Chain Manag.* **49**(4), 96–107 (2013)
49. Eckhaus, E., Klein, G., Kantor, J.: Experiential learning in management education. *Bus. Manag. Educ.* **15**(1), 42–56 (2017). <https://doi.org/10.3846/bme.2017.345>
50. 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). <https://doi.org/10.3176/tr.2018.3.04>
51. 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)
52. Eckhaus, E., Davidovitch, N.: Improving academic conferences – criticism and suggestions utilizing natural language processing. *Eur. J. Educ. Res.* **7**(3), 445–450 (2018). <https://doi.org/10.1016/j.sosci.2018.08.001>

53. Eckhaus, E.: Measurement of organizational happiness. 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, pp. 266–278. Springer International Publishing, Cham (2018)
54. Eckhaus, E., Sheaffer, Z.: Managerial hubris detection: the case of Enron. *Risk Manag.* **20**(4), 304–325 (2018). <https://doi.org/10.1057/s41283-018-0037-0>
55. Razavi, A.H., Matwin, S., De Koninck, J., Amini, R.R.: Dream sentiment analysis using second order soft co-occurrences (SOSCO) and time course representations. *J. Intell. Inf. Syst.* **42**(3), 393–413 (2014)
56. 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)
57. Li, Z., Xiong, Z., Zhang, Y., Liu, C., Li, K.: Fast text categorization using concise semantic analysis. *Pattern Recogn. Lett.* **32**(3), 441–448 (2011)
58. Eckhaus, E.: Corporate transformational leadership’s effect on financial performance. *J. Leadersh. Account. Ethics* **13**(1), 90–102 (2016)
59. Eckhaus, E.: A shift in leadership. *Acad. Strat. Manag. J.* **16**(1), 19–31 (2017)
60. Klein, G., Eckhaus, E.: Sensemaking and sensegiving as predicting organizational crisis. *Risk Manag.* **19**(3), 225–244 (2017). <https://doi.org/10.1057/s41283-017-0019-7>
61. Tabachnick, B.G., Fidell, L.S.: *Using Multivariate Statistics*, 6th edn. Pearson, Boston (2012)
62. Law, B., Shek, D., Ma, C.: Gender invariance of family, school, and peer influence on volunteerism scale. *Res. Soc. Work. Pract.* **25**(1), 139–146 (2015)
63. Bayman, A.: ‘Large hands, wide eares, and piercing sights’: The ‘discoveries’ of the Elizabethan and Jacobean witch pamphlets. *Lit. Hist.* **16**(1), 26–45 (2007)
64. Steffen, S.L., Fothergill, A.: 9/11 volunteerism: a pathway to personal healing and community engagement. *Soc. Sci. J.* **46**(1), 29–46 (2009)
65. de Reuver, M., Bouwman, H.: Dealing with self-report bias in mobile internet acceptance and usage studies. *Inf. Manag.* **52**(3), 287 (2015)
66. Brockner, J., Senior, D., Welch, W.: Corporate volunteerism, the experience of self-integrity, and organizational commitment: evidence from the field. *Soc. Justice Res.* **27**(1), 1–23 (2014)
67. Augustine, A.A., Mehl, M.R., Larsen, R.J.: A positivity bias in written and spoken English and its moderation by personality and gender. *Soc. Psychol. Pers. Sci.* **2**, 508–515 (2011)
68. Garcia, D., Garas, A., Schweitzer, F.: Positive words carry less information than negative words. *Data Sci.* **1**(3), 1–12 (2012)
69. Kang, C., Handy, F., Hustinx, L., Cnaan, R., Brudney, J.L., Haski-Leventhal, D., Zrinscak, S.: What gives? Cross-national differences in students’ giving behavior. *Soc. Sci. J.* **48**(2), 283–294 (2011)
70. Akbar, M.M., Parvez, N.: Impact of service quality, trust, and customer satisfaction on customers loyalty. *ABAC J.* **29**(1), 24–38 (2009)



Inno-Kinetic: Innovative Approach for Strategic Management

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Abstract. Since 1971 when concept of corporate strategy was proposed, strategic management has been the most powerful approach for all types of business management and administration. Strategic management has been challenged by many scholar's fields such as; resource base theory, industrial organization theory, contingency theory, and etc. Supportive strategic management theories also have been developed and created.

In last decade, innovation appears in business battlefield as key weapon that indicate winner or loser. There are many researches explain on innovation, characteristics, typology, effect on business success and etc. All strategists in business have no doubt on innovation and try to create it in their firms. Furthermore, process of innovation has been regarded as the center of interests from many business fields to find out and leading to 2 different models: closed and open innovation, to make innovation done in business firm. After that, numerous innovations were launch to market and make "adverse event"; change value and supply chain, disrupts old version product, change business model and etc., that significantly impact business environment, but no one exactly describe the phenomena as above. This paper is the first to explain the adverse effect in the relation to theory and provide argument with some strongly evidence.

Kinetic, resulting from motion, are used to be the basic approach, and five phases of Inno-Kinetic (Kinetic of Innovation) are proposed to explain the movement of innovation in this paper

After innovation is launched, innovation's movement will influence many compositions of business. The empirical evidence show that some innovation affects the business before its establishment, **The Zero phase, "4As phase"**, innovators must diffuse some knowledge for value chain and supply chain creation. Relative businesses within business environment will take responsibility in 4 As; adopt, adjust-adapt, advocate and avoid, that will shape innovation feature. **The 1st phase; "All or None phase,"** key compositions as rival and customer are dominant role to accept or reject. Acceptation of them will induce support from others to access some specific resources (on not resist to acquire). On the other hand, rejection will induce resistance to operate that some

innovation that is destroyed by rejection. **The 2nd phase, “Absorption phase,”** after first group of potential customers accept innovation, some of them, who act as the influencer will be the key opinion leader (KOL), who will take role as the “Guru” and send messages about advantage of innovation to other change agents. **The 3rd phase, “Distribution phase,”** the message will be quickly distributed from the change agents both through the formal and informal communication. At this phase, personal bias is the most powerful to drive demand (or inhibit). **The 4th phase, “Digestion phase,”** all customers will experience innovation by themselves then make a decision whether to repeat or reject. The last phase, “3 Es phase”, response of innovation will reflect the owner to evaluate (1st E) and find solution that will make elongation (2nd E) of innovation life cycle or time to the end (3rd E).

Under the hypothesis, good strategy come from suitable data, the 5 phases of Inno-Kinetic may be innovative approach for strategic management in the future.

Keywords: Innovation management · Strategic management · Kinetic on innovation · Inno-Kinetic

1 Introduction and Background

Under mainstream of business administration, strategic management (SM) is accepted and prioritized as the 1st step of business activities. According to Stanford research institute, “strategy” is defined as the path of the firm, reacting to specific environment, utilized its key resources and sequenced its main efforts in pursuit of its business objectives. Almost SM concept based on industrial organization theory that develop from business policy [1] to corporate strategy [2], are originally created from Prof. Kenneth R. Andrews, Harvard Business School (HBS). The theory’s assumptions are two main points; (1) business should run for “Realistic Hope” in term “Opportunity” and (2) business should run on “Optimized Potential Resources” in term “Strength.”

More and deep in details on process of the theory are explained by “Environment Analysis” from the same school of thought. Michael E. Porter created two compositions to describe business environment; external environment, internal environment, under “Control VS Uncontrol Concept” [3]. After that, external environment was separated to macro environment—affect overall businesses—and microenvironment—only affect specific business that is a must requirement for present strategic management.

In 1980 [4] and 1985 [5], Michael E. Porter contributed two related theories in term “3 Generic Strategies” to recommend firm’s competitive strategies; cost leadership, focus and, differentiation, in which it were classified by product/service specific value and “Value Chain” to explain element of firm’s internal process. Some initiates that were created by strategic direction are the most powerful secret weapons to decide the winner in battlefield.

Many businesses attempt to develop “The weapon” for victory and also find sources of them. It is no great surprise that estimation of success rate from development is 2–18% [6]. Furthermore, small and medium-size businesses have significant higher

success rate than large size businesses. In deep detail, success rate look like it is depending on two factors, value of firm's output and effect on market size. Under assumption of limited market, both of factors strongly affect existing products and diversified some firm alliances to enemies. The best situation should be "each product has private safe zone," then "Blue Ocean Strategy; BOS" was develop as the new paradigm to "fight or flight" by Kim [7] from INSEAD; *Institut Européen d'Administration des Affaires* or European Institute of Business Administration. "Why we should share if we can create new one again and again" is the concept of BOS. The BOS as a helm for drive to find "New Value" and "New Market" in the ocean, the secret weapon in term of "Innovation."

Since the starting of twenty century, innovation is the most popular term that was use to find and also described. There are many technological theories create assumption on "Process of Innovation," but it is settled in 2 domains. The first domain is classical model or closed innovation; Towards the 5th Generation Process [8] that greatly explained each innovation development's step under stake holder's viewpoint, innovator, customer, organization, and supply chain's composition. The other domain, open innovation was established under assumption that not only in-house process can make innovation happen, but also outside process can or "Innovation can come from everywhere" [9]. While value creation of product and service was produced by both domain of the process, some argument reflected total results as doubt, "whether Innovation is the best for business?". Number of "Destructive Technology/Innovation" [10] tends to increase and number of previous generation product seems diminishing. It is important to keep in mind that innovation have both side of coin, create the new and destroy the origin in the same time. Both effects of innovation should be explained to understand how to create and why. Moreover, "Know How" to prepare organization, from initial day to finished day, should constructed and develop to standard operating procedure (SOP) in the workplace

The main purpose of study is the investigation of movement's phenomena on innovation's effect from case reports or public evidence. Theories and related are used to explain the phenomena, kinetic of innovation; Inno-Kinetic, that which cause of the effect.

2 Concept of Inno-Kinetic

2.1 Key Assumption of Innovation Movement

Under main assumption of the study, "Innovation is the control-subject"; meanly focus on product innovation that give some average benefit of industry to a company, innovation was adopted by any business firm based on its value, not by strategic direction. The 2nd assumption is "Normality of innovation's diffusion". Innovation's adoption curve [11] was used to construct path of innovation from innovator, early adopter, early majority, late majority to laggard. The 3rd assumption is "Open innovation is source of innovation" [12]. All firm has opportunity to acquired innovation both inside and outside, limited resources from external organization was excepted in the study. The last assumption is "Innovation has sigmoid function, similar with

technology S - Curve” [13]. At initial phase, innovation has small degree of performance’s growth and very large degree in middle phase, then die in the final phase.

2.2 How the Company Response to Innovation?

Zero Phase (4As; adopt, adjust-adapt, advocate and avoid)

Base on 1st and 2nd assumption, Innovation is good by itself, not depend on strategic direction. **The first A; Adopt**, the company can adopt innovation using three ways, logical adoption, emotional adoption, and regulatory adoption. Logical adoption and emotional adoption is opposite side each to other, concern of value/result will be the cause of ignorance to innovation appearance, and innovation taste can blind cost – effectiveness concern. Empirical evidence was proved in all of company use logical adoption as the priority method similar with “Project Selection.” Both of project selection method; non-numeric and numeric, based on cost-benefit approach. The difference of them is judgment’s scale but the same principle. In large company, there are standard protocols to selected value-added innovation, process to prove it has minimized risk and maximize return. But not as small and medium company, logical adoption is depending on only start-up person in term entrepreneur that make false positive; right result not by significant consequence, from puzzlement between “logic” and “bias.” However, both large and small-medium companies still make decision on logical adoption, although not the same theory for judgment.

Furthermore, innovation was in-prompt adopted company’s staff and formal perception. Company is legal entity then it cannot act any active process. Searching information duty was put on them to find something new for improve their works. They must concern on integrated routine works and innovation and trade off personal benefit; reward, career’s promotion, etc., with personal cost; time consume, worked load, responsibility, etc. Innovation will adjust; process of evaluation which degree to adopt and how to apply in the company, to simplified and compatible with normal procedure. In case of compatibility, staff who take responsibility of the innovation must create “new procedure” for it, some processes of innovation were adapted and blend with standard procedure. **After the second 2 A; Adjust and Adapt was happened**, the new procedure was verified and calibrate, then standard operating procedure was contributed to company’s value-added process. There are no evidence to the specified range of duration on adjust and adaption but was estimation from expected time of critical path in condition Z-Score, 95% confident interval and 5% error [15].

After new standard procedure was created, the third A; Advocate and the fourth A; Avoid was induced in the same time. New standard procedure was **advocate** by “cost-benefit” paradigm, but not “self-concern” paradigm. Staff as previous paragraph must find method how to increase supporter and how to **avoid** the conflict from new procedure. All most company look like success to balance 2 A; advocate and avoid, in initial stage but cannot guarantee for sustainment. The effect of company politic dilemma should be concerned and monitored for the future study (Fig. 1).

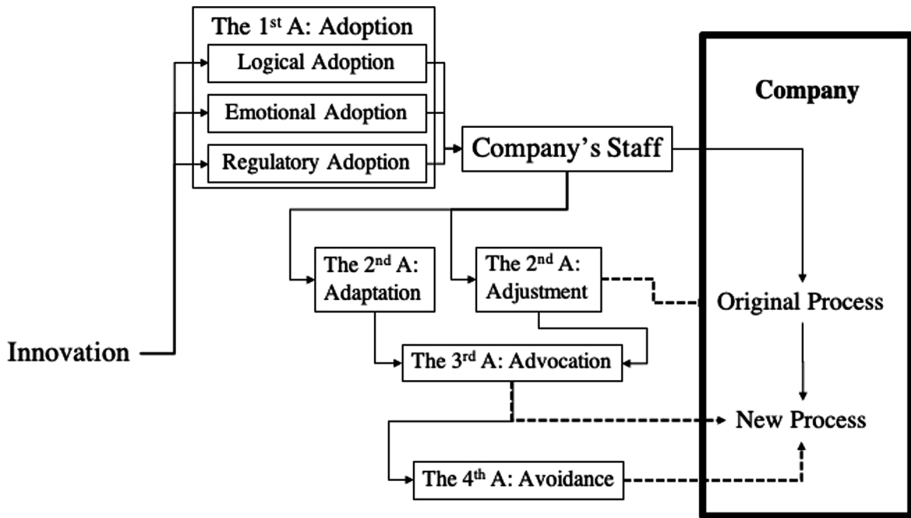


Fig. 1. The relationship between 4As; Adoption, Adjust and Adopt, Advocate and Avoid, in the zero phase

2.3 How Business Environment Response to Innovation?

The 1st phase; “All or None phase”

According to Porter’s business environment (5 forces model; compose with rival, customer, supplier, new entry and substitute), the company proposed specific value to the market. Every companies whom can create the same values and compete the others, want to be the largest proportion of market share but not for innovation. Innovation base on “differentiation” then the company that focus on innovation try to build new value again and again. This argument sounds like innovation has no rivals in the business. In fact, innovation’s competitor was described by diffusion of innovation [15] that the most powerful competitor is “customer’s logic”. Innovation must induce degree of every customer group’s acceptance and must do sequential step by step from the first group who tend to adopt new product from personal test (INNOVATOR was used in marketing field), early adopter (in trend customer), early majority (reasonable customer, late majority (social leading customer) to laggard (skeptical customer). In worse case, the company cannot convince innovator’s logic who is starter of product life’s cycle the innovation cannot appear in the market. Regarding to Moore’ chasm [11], every successful innovation must come across the chasm between early adopter and early majority (increasing degree of adoption to more than 16%). The conclusion from the academic reference shows that **“success of innovation depends on All; across chasm or None; cannot across chasm, from fail in innovation or early adopter.”** However, each group of previous explanation customer are many sub-logical concepts to make a decision to adopt or reject innovation that hard to define sources of logical mechanism on them.

2.4 How Customer Response to Innovation?

The 2nd phase; “Absorption”

After innovation across the chasm (market demand was increased to more than 16%), innovator and early adopter put role as “expert” who more experience on innovation. The experience was important factor for recognition of them. Using of innovation repeats in the same unit of adopter especially in innovator. Some evidence supports that innovator come from the lead users who are related to product’s influencer and key opinion leader: KOL that their explanation are perceived from numerous followers. Information from KOL’s explanation was widespread and absorbed, both above the line and below the line marketing communication. In the same time, the information was used by each other KOL to support their expression.

2.5 How Early Majority Response to Innovation?

The 3rd phase, “Distribution phase”

Information regarding innovation that proposed by KOLs, was distributed to early majority who concern about the suitable decision. They will analyze some information and compare it with personal experience. Both good and bad experience are mixed and sediment on 4 ways; continue accept or reject, switch accept to reject, or switch reject to accept. According to adoption curve, early majority is 34% of total adopter that critical proportion to accelerated rate of innovation’s success. Consensus of them is the most powerful to distribution innovation (or un-distribution). In the other approach, the information was received by the other company and used to develop their product, potential new entry in industry (Fig. 2).

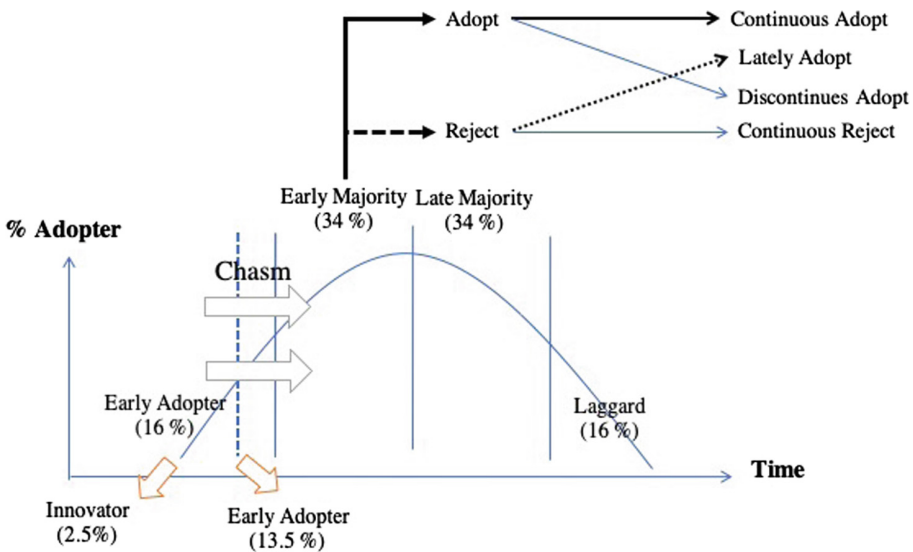


Fig. 2. The mechanism of distribution phase

2.6 How the Lest Response to Innovation?

The 4th phase, “Digestion phase”

Under the assumption that innovation is a product, product life’s cycle was used to explain the growth of it. Once innovation is at the middle cycle. High rate of increasing market value was strongly induced in short period then slowly accelerated and stable. Saturated market value depends on **the 1st E; evaluation** to strategic re-consideration that how to sustainable market growth. According to Smith [16], innovation strategy was applied to existed business strategy; the first mover for insist the business strategy, the imitator/follower for take time to find some evidence and confirmation, and alliance for their business strategy that has some weak argument that can manipulate it.

The result from the 1st E diverts to 2 scenarios. Successfully scenario is the business’s expectation that can make **the 2nd E; Elongation** of product life’s cycle both y-axis, market value and x-axis, time. The total return on investment from the 2nd E is going to more increased than previous. In the other hand, failure scenario might happen in the worst case and make **the 3rd E; the End** of the cycle. There are many factors that can explain why innovation fail but are not define absolutely as key failure factor. This issue should be studied in the future.

3 Conclusion

Innovation is the key success factor and key failure factor in the same time. Innovation’s movement can describe the phenomena. Furthermore, the reaction from environment to innovation is the mechanism that the company who propose innovation to the market must concern. Contribution of this study, 5 phases of inno-kinetic is recommended as the guideline for the company who focus on innovation as product to concern at the critical point.

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References

1. Andrews, K.R.: Executive training by the case method. *Harvard Bus. Rev.* **29**(5), 58–70 (1953)
2. Andrews, K.R.: *The Concept of Corporate Strategy*. Homewood, Irwin (1971)
3. Porter, M.E.: How competitive forces shape strategy. *Harvard Bus. Rev.* **57**(2), 137–145 (1979)
4. Porter, M.E.: *Competitive Strategy*, pp. 234–259. Free Press, New York (1980)

5. Porter, M.E.: *Competitive Advantage: Creating and Sustaining Superior Performance*, pp. 11–30. Simon and Schuster, New York (1985)
6. Ulwick, A.W.: Turn customer input into innovation. *Harvard Bus. Rev.* (January), 91–98 (2002)
7. Kim, W.C.: Blue ocean strategy: from theory to practice. *Calif. Manag. Rev.* **43**(3), 105–121 (2017)
8. Rothwell, R.: Towards the 5th generation innovation process. *Int. Mark. Rev.* **11**(1), 7–31 (1994)
9. Chesbrough, H.: *Open Innovation: The New Imperative for Creating and Profiting, from Technology*. Harvard Business School Press, Boston (2003)
10. Christensen, C.M.: *The Innovator's Dilemma: When New Technologies Cause Great Firm to Fail*. Harvard Business School Press, Boston (1997)
11. Moore, G.A.: *Crossing the Chasm*. Harper Business Essentials, New York (1991)
12. Chesbrough, H.: The logic of open innovation: managing intellectual property. *Calif. Manag. Rev.* **45**, 33–58 (2003)
13. Foster, R.: *Innovation: The Attacker's Advantage*. Summit Books, New York (1986)
14. Mantel Jr., S.J., Meredith, J.R., Shafer, S.M., Sutton, M.M.: *Project Management in Practice*, 4th edn. Wiley, Hoboken (2011)
15. Cottrill, C.A., Rogers, E.M., Mills, T.: Co-citation analysis of scientific literature of innovation research tradition: diffusion of innovation and technology transfer. *Sci. Commun.* **11**(2), 181–208 (1989)
16. Smith, D.J.: *Exploring Innovation*, 3rd edn. McGraw-Hill Education, Nottingham (2016)



Lean Manufacturing Model Based on Knowledge Management to Increase Compliance in the Production Process in Peruvian SMEs in the Textile Garment Sector

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Abstract. Over time, the textile sector has been globally represented and characterized by increasingly demanding customers, which has forced companies to seek more flexible processes. However, these changes in production methods have also generated greater wastes, a common problem, which also leads to a greater number of defaults on meeting the demand. As a result, several efforts have been made to solve this issue, such as using emerging Lean or Just-in-Time philosophies with different approaches. Likewise, high sector turnover sometimes causes learning to become tedious, thus affecting the knowledge which has already been acquired. Therefore, this paper proposes a Lean Manufacturing model, bolstered by knowledge management to guarantee its viability over time. A simulation using the Arena software reduced non-compliances with companies' production schedule up to 80%.

Keywords: Lean Manufacturing · Knowledge management · Demand defaults

1 Introduction

The textile garment sector has historically represented a significant GDP percentage in various countries around the world. For Peru, this sector represents about 1.3%, generating approximately 500,000 formal jobs [1]. However, the financial crisis of 2008 brought about major changes to the sector: Peruvian clothing exports fell by almost 40% [2]. In addition, over time, customers have become more demanding, seeking superior quality, lower operating costs, and quicker delivery times. This has forced Peruvian textile companies to work with greater flexibility and a larger variety of products [3, 4]. These changes have generated various wastes in the manufacturing

processes, which directly affects how these companies meet their demands and translates into rising costs and lower profit margins [5]. The efforts made to mitigate the problem include the use of several Lean Manufacturing or Just-in-Time tools to offset time or resource limitations by seeking accurate coordination within the supply chain, respectively.

As a possible solution and after an exhaustive literature review, Lean Manufacturing approaches may prove adequate in mitigating or reducing the problem by generating significant changes. Some of the approaches found include using SMED to reduce changeover time, Line Balance for an optimal allocation of resources, and Kanban to secure a continuous flow and determine production rates. These three approaches have not yet been included in the literature reviewed. Likewise, the textile industry is characterized by the level of volatility and variability of its environment. This is frequently reflected in the high staff attrition reported for the sector, which occasionally also causes process delays. In this light, knowledge management emerges as an effective coping alternative. In fact, knowledge management is critical for the proposal to be sustained over time [6].

This study is structured as follows: Sect. 2 includes the literature review. Section 3 describes the proposal and its contribution. Section 4 discusses the case study on which this study was based. Finally, Sect. 5 provides conclusions and recommendations.

2 State of the Art

The different wastes found in the textile garment production process are considered one of the main factors that cause textile companies to default on their production goals, which refers to not being able to meet their demand on time. Many authors have focused on proposing solutions that seek to reduce and/or eliminate these wastes from different perspectives but always at the least possible investment [7].

2.1 Inadequate Resource Allocation

One of the most predominant problems in the textile garment production process is inadequate resource allocation. A first 2015 study proposed a unique mathematical model with the purpose of balancing an assembly line when requiring adapting to different production conditions, obtaining time and investment reductions for each new production requirement [8]. On the other hand, a study conducted in 2016 establishes the use of simulation methods to balance production lines, accounting for the stochastic nature of the manufacturing process and including factors such as time variability, machine downtimes, and correction of defective products or operator interruptions. The gap between production goals and actual production was reduced by a significant percentage [10].

2.2 Knowledge Management

Knowledge Management emerges as a proper tool for sustaining the proposal over time. A 1993 study was one of the first to propose a flexible and specific model

characterized by using colloquial terms in four stages: building, maintaining, grouping, and applying knowledge. One of the defining factors for this model is that it focuses on the individual, the work group, as well as the organization itself [11]. In 2005, a different model proposed a six-phase knowledge management cycle: creating, assessing, sharing, contextualizing, applying, and updating knowledge. This way, processes may always be improved within the acquisition of knowledge [12].

Based on the review conducted, a need was identified for a Lean Manufacturing-based model that encompasses these aforementioned approaches to obtain optimal resource allocation and ensure project viability over time. In addition, other tools may be required, such as SMED, to achieve an ideal changeover time, and Kanban, to establish an on-demand production flow. Even when these approaches have not been grouped before, they can be useful to reduce defaults in the production schedules of this sector.

3 Collaborations

At first instance, reduction in changeover time due to a change of model is set forth as a primary condition for establishing the optimum set up time within the multi-product production lines. Thereafter, proper resource allocation based on the number of production batches, personnel, and machines reduces bottlenecks and improves demand compliance. With the data obtained, new on-demand production flows may be defined, thus reducing in-process inventory. Supplementing the merging of different Lean approaches, knowledge management may be applied to effectively sustain the new working paradigms (Fig. 1).

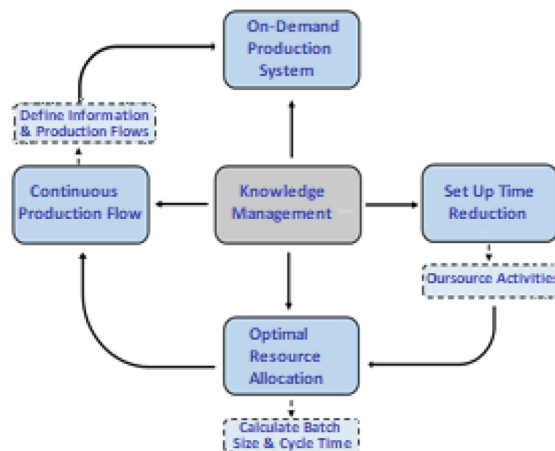


Fig. 1. Proposal design. Starts with the reduction of changeover times, continues with an optimal resource allocation, and finally establishes a continuous on-demand production rate. Transversely, the proposal denotes knowledge management.

3.1 Resource Allocation in Work Stations

Resource allocation includes the optimal allocation of activities and machines in work stations to meet the given demand. For these purposes, a simple linear programming model was used for cycle time streamlining. To calculate resource allocation, the principle of line balance [9] is used, making various adjustments to achieve the desired contextualization. Tables 1, 2, and 3 define the indexes used when developing the linear programming model.

Table 1. Indexes

Indexes	Description
i	Activity index, i = 1, 2 ... , n
j	Station index, j = 1, 2, 3, 4

Table 2. Parameters

Parameters	Description
Tsu	Set up Time
Tpu	Unit Processing Time
Tc	Cycle Time
N	Number of set up configurations
D	Daily demand
Cj	Bottleneck of each j station
Tk	Average Takt Time

Table 3. Variables

Variables	Description
Xij	Number of activity i machine/operators in station j

The proposed-target function is defined as the minimization of the total cycle time.

$$\text{Min } Tc. \tag{1}$$

$$Tc = Tsu \times N + D \times \sum (Tpu/Xij) \tag{2}$$

Some of the restrictions proposed are:

$$Tpu/Xij \leq Cj \tag{3}$$

$$\sum (Tpu/Xij) \leq Tk \tag{4}$$

Where:

- Equation (3) seeks to reduce the total production time of each work station.
- Equation (4) limits the total production time to the process Takt Time.

The results obtained are based on the optimum total cycle time together with the number of machines/operators needed to meet the given demand.

3.2 Knowledge Management

A Knowledge Management model should be applied as long as a need or “Request for Knowledge” is identified. In this case, this model is considered necessary because an innovation stage is started through the proposed tools, which implies changes to some operations. Next, the different phases and their application method are explained [13] (Fig. 2).

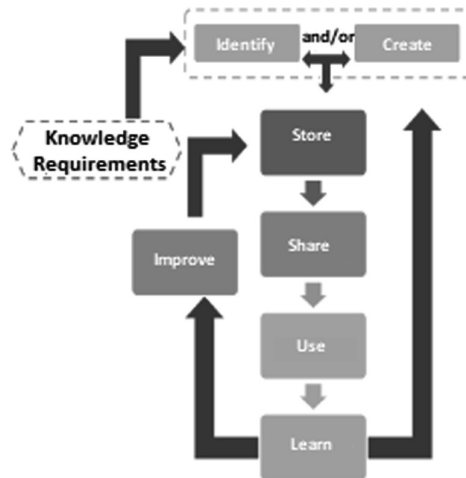


Fig. 2. Knowledge Management model. The proposed methodology includes six stages, which are part of a continuous cycle that preserves the knowledge acquired within the company through time.

a. Identify and/or Create

This phase determines whether knowledge already exists or whether new knowledge must be created.

b. Store

Once valuable knowledge has been identified, it must be tacitly retained in the form of audits or maps or explicitly retained by creating templates, annotations, or records.

c. Share

Once knowledge has been stored, communication channels must be established to share this knowledge and prevent it from being lost over time.

d. Use

Once knowledge has been shared, it must be used to make decisions and promote innovative thinking.

e. Learn

This stage assesses whether the knowledge assets shared and used are valuable for the organization. If the knowledge is deemed valuable, it may go through a phase of refinement. Otherwise, the process returns to the knowledge identification/creation phase.

f. Improve

At this point, it must be decided whether the knowledge assets will be archived, withdrawn from the organization, or transferred.

As part of the proposal implementation, process phases are established using the Lean Manufacturing approach supported by knowledge management and the way in which both concepts relate to each other. This is presented in Fig. 3. In each phase, there must be a “Share Knowledge” process, as this will be improved over time and must be transmitted from phase to phase for the model to work. Also, phases b, c, and d use the knowledge acquired in training as a starting point. Then, they rely on experience to identify new ways of performing tasks, which allows for continuous improvement.

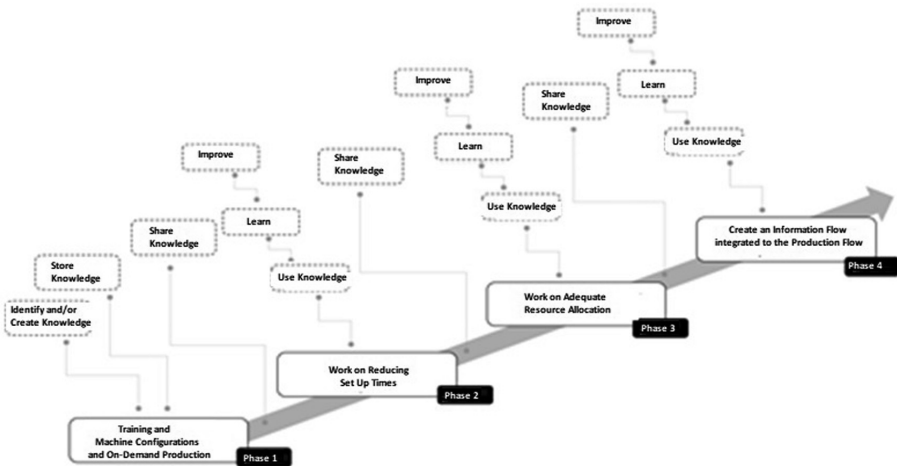


Fig. 3. Proposed model flow chart. The four implementation phases are displayed, as well as the Knowledge Management methodology in a transversal way.

4 Validation

The proposal is validated through the simulation of the production environment of the XYZ Peruvian Company, which manufactures and exports garments. This company works with four manufacturing cells or production modules and only manufactures pants and Bermuda shorts. This company, presents a 21% non-compliance with its production schedule, generating an economic impact of 12% in cost of sales based on an increase in penalties and additional labor costs, as denoted in Table 4.

Table 4. Current situation

Indicators	Current
Average In-Process Inventory	391 garments
Average Set up Time per Production Module	49.20 min
Production Default Rate	21%
Economic Impact	12.00%
Order Fulfillment	77%
Proposed Communication Scope	0%

Functional validation was based on the production process within a production module, taking into account aspects such as product types, processing times, number of machines, and production time, among others. For these purposes, it was first necessary to follow the established implementation steps:

- Staff training simulation is offered based on the number of people working within this particular production module, which employs between 50 and 60 workers.
- Optimal Changeover Time due to Model Change using the SMED tool: The calculated optimal time is 40.90 min, unlike the 49.20 min currently reported.
- Optimal Activity Allocation according to Line Balance: Regarding the machines used, 61 are required against the 47 currently used.
- Workflow as per the Kanban system: From the literature, the application of the Kanban system reduced in-process inventory by approximately an additional 30% [14].

Then, the results obtained using the “Arena” software are shown, based on the optimal scenario. That is, a scenario where all the exposed parameters are fulfilled in their entirety (Table 5).

Table 5. Results

Indicators	Current	Proposal	Value	Variation
In-Process Inventory Reduction (%)	391 garments	241 garments	-38.35%	Decrease
Reduction of Set up Times per Production Module	49.20 min	40.90 min	-16.87%	Decrease
Production Default Rate	21%	4%	-80.95%	Decrease
Economic Impact	12.00%	2.60%	-78.33%	Decrease
Order Fulfillment	77%	95.53%	+24.06%	Increase

Supplementary, the “Proposed Communication Scope” indicator was validated as a short-term metric to identify an initial scope for the knowledge proposal. Currently, the theoretical base of the proposal is already known by 75% of the required employees.

5 Conclusions

- The proposed solution in would reduce the problem by approximately 80% an optimal scenario, which is for a company.
- This 80% reduction could eventually reduce economic impacts by 78%. Likewise, in terms of knowledge management, a short-term result was achieved in which 75% of employees already possess the required basic implementation information. However, to fully measure its impact, at least one year of work would be required.
- The proposed model is geared towards solving delays from set up times, in-process inventories, and inadequate resource allocation. These issues may be reduced through the use of Lean Manufacturing tools paired with the implementation of a Knowledge Management model to sustain this solution over time.

References

1. Demi Produce. <http://demi.produce.gob.pe>
2. Banco Central de Reserva del Perú. <https://estadisticas.bcrp.gob.pe>
3. Vamsi, K.J.N., Kodali, R.: Validity and reliability of lean manufacturing frameworks: an empirical study in Indian manufacturing industries. *Int. J. Lean Six Sigma* **5**(4), 361–391 (2014)
4. Salonitis, K., Tsinopoulos, C.: Drivers and barriers of lean implementation in the Greek manufacturing sector. *Procedia CIRP* **57**, 189–194 (2016)
5. Vijayakumar, G., Robinson, Y.: Impacts of lean tools and techniques for improving manufacturing performance in garment manufacturing scenario: a case study. *Int. J. Adv. Eng. Technol.* **7**(2), 251–260 (2016)
6. Omotayo, F.O.: Knowledge management as an important tool in organisational management: a review of literature (2015)

7. Shah, Z.A., Hussain, H.: An investigation of lean manufacturing implementation in textile sector of Pakistan. In: Proceedings of the 2016 International Conference on Industrial Engineering and Operations Management, Kuala Lumpur, Malaysia (2016)
8. Makssoud, F., Battaïa, O., Dolgui, A., Mpofu, K., Olabanji, O.: Re-balancing problem for assembly lines: new mathematical model and exact solution method. *Assem. Autom.* **35**(1), 16–21 (2015)
9. Samadhi, T.M.A.A., Sumihartati, A.: Model for assembly line re-balancing considering additional capacity and outsourcing to face demand fluctuations. In: IOP Conference Series: Materials Science and Engineering, vol. 114, no. 1, p. 012092 (2016)
10. Wickramasekara, A.N., Perera, H.S.C.: An Improved Approach to Line Balancing for Garment Manufacturing
11. Burduk, A., Chlebus, E., Nowakowski, T., Tubis, A. (eds.): *Intelligent Systems in Production Engineering and Maintenance*, vol. 835. Springer (2018)
12. Bukowitz, W.R., Williams, R.L.: *The Knowledge Management Fieldbook*. Financial Times Prentice Hall, Great Britain (1999)
13. Heisig, P.: Harmonisation of knowledge management: comparing 160 KM frameworks around the globe. *J. Knowl. Manag.* **13**(4), 4–31 (2009)
14. Mazurkiewicz, D., Burduk, A.: *Intelligent Systems in Production Engineering and Maintenance, ISPEM 2017* (2018)

Business Development



Intermediary Organization and Collaboration Platform for SMEs

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Abstract. Due to globalization and the ever-changing business environment, Small and Medium Size Enterprises (SME) need to be efficient and competitive in order to survive. Interfirm collaboration becomes helpful to achieve the company's target. However, most of the SMEs are not able to collaborate effectively. This article, therefore, focuses on the underlying factors that affect SMEs interfirm collaboration while having in mind the role of intermediary organization and collaboration platforms play. A mixed strategy research method that includes qualitative and quantitative approach is used. The theoretical framework analyses different type of interfirm collaboration, intermediary organization and collaboration platforms. Based on the theoretical model of interfirm collaboration, the results indicate the need for SMEs in that regard based on the analysis of a survey. They consider collaboration as an important part of their business. However, their biggest problems remain the lack of resources, inability to find a suitable partner and adequate digital tools.

Keywords: Interfirm collaboration · Collaboration platform · SME · Intermediary organization · Internal collaboration · External collaboration

1 Introduction

According to the European Union Commission, SMEs in Europe account for 99% of all Businesses [1]. Although having limited resources and less external support, they need to compete with larger institutions [2]. Furthermore, due to the globalization of the business environment, it is important that SME's explore avenues they can employ to promote their business. A successful collaboration not only creates benefit but also allows SMEs to focus on their key competence and core business. Besides, the international market pressurizes them to find innovative and flexible business solutions. A notable solution is to seek opportunities to collaborate with other organizations and to become part of a business network.

This study focuses on the underlying factors of collaboration regarding SMEs and intermediary organizations. The objective of this paper, therefore, is to find out the current state of interfirm collaboration between SMEs. Furthermore, it draws attention to opportunities created by digital platforms in building this type of collaboration,

while at the same time emphasizing the role of physical collaboration platforms and intermediary organizations. The empirical part consists of a questionnaire designed for the SMEs participating in the project. The aim of the questionnaire was to inquire about their views concerning collaboration and the use of collaboration platforms.

The paper examines the different type of collaboration between SMEs by mapping the existing collaboration platforms. It also provides the theoretical model about collaboration and analyses the questionnaire provided. As collaboration is regarded as an important part of companies' activities, intermediary organizations are being used in these companies. The biggest problem though, when it comes to networking and collaboration remains the lack of resources and inability to find a suitable partner. The following research questions were thus formulated to address the current problem amongst SMEs within Finland.

- (1) How is interfirm collaboration built between SMEs and what roles do collaboration platforms play?
- (2) What kind of collaboration platform does SMEs use?

The first research question will be answered in the literature review. The second research question will be answered by analyzing the interviews. Therefore, this article is structured in four main parts to address the research questions. The first part focuses on the theoretical background about different types of interfirm collaboration and available platforms. The part two and three elaborates on the methodology used as well as the empirical part of the study. The final part draws a conclusion about the study and suggests for future research.

2 Theoretical Background

The purpose of this part is to create a theoretical framework for research on interfirm collaboration without consideration to the impact of other platform or external factors on the implementation of such collaboration. The theoretical review builds a foundation that allows assessing the platforms and business behaviors in relation to the collaboration platform in the future. According to Barratt [3], when it comes to supplying chain, there are two types of collaborations such as horizontal and vertical collaboration. Further analysis of collaboration in this way allows for closer assessment of the particularities of the different types of collaboration, which could be considered in the future not only at the operational level but also at the tactical and strategic level [3].

The advantages that SMEs derive from collaboration have been widely covered in the literature. Studies [4, 5] revealed that the sharing of information while placing emphases on the relationship between collaboration and innovation can help achieve a competitive advantage. SMEs have various internal and external reasons to engage in different business collaboration with each other. Flexibility increased competitiveness, innovation and learning are internal business results, while internationalization, risk sharing, and improved reputation are external results [3]. Similarly, collaboration can be affected by potential barriers and factors that can impact the company's operating environment [1]. For example, lack of resources, difficulties finding partners,

inefficiencies or lack of interest can prevent collaboration. Additionally, strategic management and social factors [2] influence effective collaboration.

The following parts examine more closely the various aspects of the different type of collaboration. The first part expands on about vertical and horizontal collaboration and better reflects the characteristics of collaboration, depending on the company's core business and the competitive position between them. The second part discusses collaboration at various stages.

2.1 Business Collaboration Between Small Businesses

Vertical Collaboration

This type of collaboration involves two or more organizations from different levels or stages in the supply chain who share their responsibilities, resources, and performance information to serve relatively similar end customers [6].

Horizontal Collaboration

Horizontal collaboration takes place when companies that are active at the same stage of the supply chain identify and exploit win-win situations of benefit [7]. Many studies show that such collaboration is particularly related to innovation, perhaps because companies that operate horizontally in different sectors do not, as defined, fall below the supply chain, and thus the business value chains naturally support each other [8, 9].

2.2 Intermediary Organizations and Collaboration Platforms Structure

Kanter argues that in order to benefit from a collaboration, open systems development and information sharing are necessary [5]. Collaboration platforms can be an extension of the theory of innovation mediators or as an extension to general intermediary organizations that include functions related to business-to-business collaboration or information sharing in general. In addition to the traditional and old way of building collaboration, digital or IT-based platforms are widely used and are effective.

Intermediary Organizations and Open Innovation

Recently, data transfer between companies has emerged in a new way, with patterns approaching the so-called open innovation. In a paradigm of open innovation, companies freely share information [10]. On the other hand, Intermediary organizations play an important role in handling the transfer of information between different companies or research organizations [11].

SME Platforms and Intermediary Organizations

The collaboration platform can therefore be an organization, a tool or platform that works across the interface of two or more companies by combining and helping to maintain collaboration between different tasks [11]. The collaboration platform adds value to interfirm collaboration through its own structure and mechanisms. Risikko [11] lists various intermediary organizations and collaborative platforms as follow:

- Internationalization platforms and other export organizations,
- Seminars, fairs and events,

- Research projects and other development programs,
- Regional developmental organizations and technology centers,
- Social Media Platforms,
- Entrepreneur societies, interest groups (unions), other business societies,
- Joint venture

3 Methodology

Theories presented in the previous sections help to obtain an overview of interfirm collaboration. The empirical part of this research was conducted in the form of a survey, which aimed at finding how SMEs in Finland collaborate among themselves. The questionnaire clarified their view regarding both internal and external collaboration through collaboration platforms.

The target group for this survey is made up of 19 SMEs selected from four regions in Finland and covers industrial sectors such as Tourism, Welfare, Energy and Metal industries. The questionnaire was designed based on the concept of a collaboration platform and intermediary organizations as seen in the theoretical part. It is structured in three main sections. These are:

- Section 1: Current state of interfirm collaboration
- Section 2: Relationship between collaboration platforms and the use of intermediary organizations
- Section 3: Future of SMEs collaboration and wishes regarding a collaboration platform

A qualitative and quantitative study method is employed to analyze the result from the SMEs. The Likert scale 1–7 is used to set questions that address the aim of this survey that is to act as an inductive link between theoretical and practical experiences. Subsequently, a qualitative method of analysis based on the inductive approach is employed for data description and analysis. The key components of this method include data reduction, data description, and reliable conclusions. Basically, the study has a wide range of factors affecting reliability which were considered when analyzing the results.

4 Result and Analysis

The result is divided into three parts based on the questionnaire. The first part discusses respondents' views on collaboration based on their current state of collaboration, activities and problems. The second part examines the relationship between collaboration platforms and the use of intermediary organizations. In the third part, SMEs are asked to give their opinion about interfirm collaboration and their wishes for a collaboration platform.

4.1 SMS's Opinions on Interfirm Collaboration

A thorough analysis of the first part of the questionnaire gave an insight into responding SME's point of view regarding interfirm collaboration. The first question (*How vital is an interfirm collaboration with other SMEs for your business – 19 Answers*) was about the importance of collaboration. The average of the answers as seen in the graph below was about 5.74 with 6 as the median. Most respondents (13 out of 19) saw the importance of interfirm collaboration in the scale of 6 and 7 of Likert Scale.

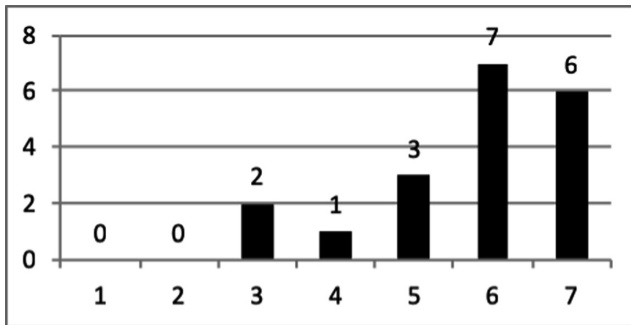


Fig. 1. SMS's opinion on the Importance of Collaboration

Similarly, in the second question (*How satisfied are you with your current state of interfirm collaboration with other SMEs? – 19 Answers*), the company's satisfaction regarding their actual state of collaboration is also measured on the Likert scale 1–7 and the result is seen in the graph below (Fig. 2). It could be seen from the results that the level of satisfaction is not in phase with the level of importance of collaboration as seen in the Fig. 1.

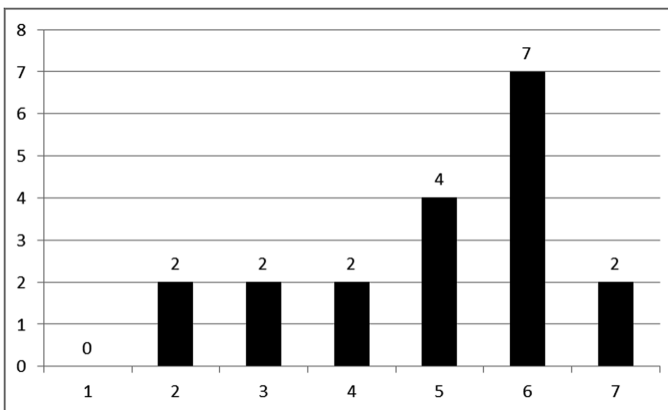


Fig. 2. SME's collaboration satisfaction

The third question (*What kind of business activities and functions does your collaboration with other SMEs involve? – 19 answers*) listed some business activities and functions that are involved in SMEs collaboration with other companies. The result as summarized in Fig. 3 helps to see that the collaboration affects all major activities and functions of the company.

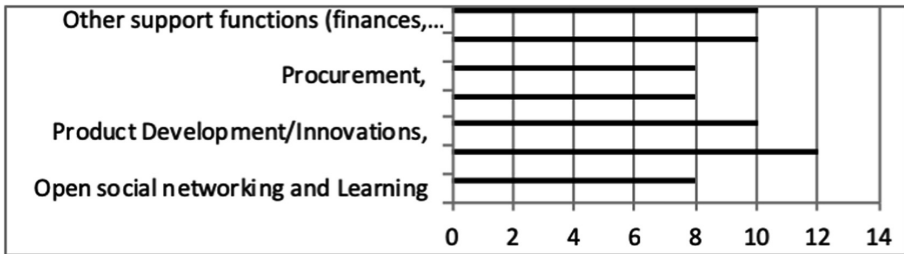


Fig. 3. SME's collaborative business activities and functions

The fourth question (*What are the biggest problems with the current situation when starting collaboration and finding contacts with other SMEs*) was an open-ended question. It has allowed companies to identify the problems they faced regarding initiating collaboration and finding suitable partners. The result listed in Table 1 shows issues SME face when initiating collaboration. They are categorized into two groups: internal factors and external factors.

Table 1. Problems starting interfirm networking and collaboration

Biggest problems faced by SMEs when starting collaboration	
<i>Internal factors</i>	
Lack of time and resources	6
Management problems	1
<i>Internal factors</i>	
Difficulties in finding suitable partners	7
Building trust and a common goal	2
Lack of development	2

According to Table 1, one of the biggest problems for SMEs to start collaboration is a lack of time. Some respondents mentioned networking as a problem, meaning that it is difficult finding suitable partners. When the starting points, goals and views of collaboration differ significantly, companies may find it difficult to find a common ground on which to start building the collaboration. The main problems of collaboration continue throughout its lifecycle, as priorities changes as integration grows deeper.

4.2 Platform Used

A list based on the analysis of the theoretical part of the mapping of various possible platforms is provided to respondents. The fifth question (*What sort of tools or platforms do you use to initialize collaboration with other SME's in the current situation?*) asked to select from a given list, tools and platforms used to initialize interfirm collaboration. The list is based on the theoretical part of the mapping of various possible platforms. The result is shown in Fig. 4. It pointed out that most of them use social media to some extent as a tool for collaboration.

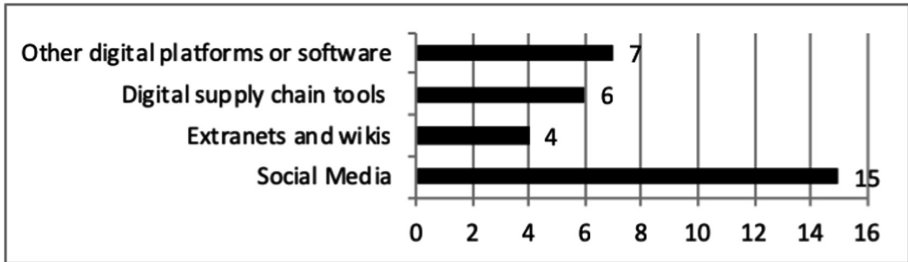


Fig. 4. Electronic and IT-based platform used by SMEs

Low operating costs, ease of use, and versatile user experience can explain why SMEs prefer social media. Other electronic platforms such as GitHub (*which is used in the software industry*) were also relatively popular among respondents.

Apart from these digital and IT-based platforms, respondents use other platforms such as lobbying groups, regional developmental organizations and entrepreneur societies. However, the most used collaboration platform remains seminars, events that require fewer investments. Besides, a relatively large proportion of companies especially technology startups also utilize various research projects platform in their collaboration.

4.3 Need for a Future Collaboration Platform

Responses concerning future collaboration are quite diverse and focused on different areas. Some of the respondents use collaboration as an avenue to export their products. However, most of them are interested in vertical collaboration by focusing on distribution channels, customer relationships, supplier relationship and sales. Other respondents hoped for future public-private collaboration, which will push for laws and legislation that favor their businesses. Some expressed the need for private workshops to support collaboration. Careful analyses of the answers to the questionnaire gave some insight about how the platform can help companies to evaluate and describe viable collaboration. However, the platform will only serve its purpose only if it is attractive and connect businesses. It should be innovative in order to avoid being a mere duplication of the existing traditional intermediary organization.

5 Discussions and Conclusion

The theoretical part of this research built the foundation for understanding interfirm collaborations and collaboration platforms. The empirical part outlined the views of Finnish SMEs on interfirm collaboration. The purpose of this part is to give a closer look at the results of the research questions.

A key part of this research was to elaborate on collaboration between companies and the available collaboration platforms. The theoretical part was to model SMEs collaboration through various theoretical frameworks. Usually, there are different types of collaboration depending on the relationship between involved companies. Some aspects of this type of collaboration involve supply chain operations that require seeking opportunities and networking through solving problems and technology transfers.

The second part of the theoretical framework examined different collaborative platforms and intermediary organizations. A rough division was made between digital collaboration platforms and intermediary organizations. Intermediary organizations can also use electronic platforms, tools or websites in their activities. These platforms serve as a mechanism that brings companies together.

In the empirical part of this paper, the questionnaire examined the views of the SMEs involved in the project regarding how they collaborate as well as how a collaboration platform may be useful for them. Answers from the survey clearly showed that SMEs consider collaboration as an important aspect of their business and are also relatively happy with the current state of their interfirm collaboration. On the other hand, some respondent regard it challenging to find suitable partners to start collaboration.

SMEs have a wide range of different collaboration platforms. However, key issues on collaboration are related to time and resources.

5.1 Recommendations

SMEs involved in this research expressed various needs and wishes regarding future interfirm collaboration platforms. However, this research is limited in knowing their needs. It is therefore important to design a digital platform with features and tools that can be useful for the in handling their collaborative business activities and functions.

5.2 Conclusion

Collaboration is a complex and broad concept that is difficult to define and study. New technologies will advance collaboration through the development of digital platforms. Collaboration between SMEs provides opportunities to overcome challenges when competing with larger firms to enhance their limited resourced businesses.

Considering interfirm collaboration as a process, there may be two or more companies, making use of either intermediate organization and/or collaboration platforms. Furthermore, companies are positioned in supply chains in relation to each other either horizontally or vertically. Collaboration, therefore, advances their integration, from networking to deeper collaborations. They need to adapt to the ever-changing business

environment by setting up their own digital collaborative platforms through new technology employment.

The empirical part of the study by means of this survey has helped to map out practical views on collaboration and collaboration platforms from the SMEs perspective. Collaboration between companies will still require more research in the future. It will also be prudent to study the collaboration within companies in order to analyze the impact on its growth.

References

1. European Commission. http://ec.europa.eu/growth/smes/business-friendly-environment/sme-definition_en. Accessed 4 Feb 2019
2. Casals, F.E.: The SME co-operation framework, a multi-method secondary research approach to SME collaboration. In: 2010 International Conference on E-business, Management and Economics, vol. 3, pp. 118–124 (2011)
3. Barratt, M.: Understanding the meaning of collaboration in the supply chain. *Supply Chain Manag.: Int. J.* **9**(1), 30–42 (2004)
4. Coombs, R., Richards, A., Saviotti, P.P., Walsh, V.: *Technological Collaboration: The Dynamics of Collaboration in Industrial Innovation*. Edward Elgar Publishing (1996)
5. Kanter, R.: Collaborative advantage: the art of alliances. *Harvard Bus. Rev.* **72**, 96 (1994)
6. Chan, F.T., Prakash, A.: Inventory management in a lateral collaborative manufacturing supply chain: a simulation study. *Int. J. Prod. Res.* **50**(16), 4670–4685 (2012)
7. Cruijssen, F.: Co3-Project.Eu (2019). <http://www.co3-project.eu/wo3/wp-content/uploads/2011/12/CO3-D-2-1-Framework-for-collaboration-full-report-2.pdf>. Accessed 4 Feb 2019
8. Bengtsson, M., Raza-Ullah, T.: A systematic review of cooperation: toward a multilevel understanding. *Ind. Mark. Manag.* **57**, 23–39 (2016)
9. Bouncken, R.B., Gast, J., Kraus, S., Bogers, M.: Competition: a systematic review, Synthesis, and future research directions. *RMS* **9**, 577 (2015)
10. Chesbrough, H.W.: *Open Innovation - The New Imperative for Creating and Profiting from Technology*. Harvard Business School Press (2003). 227 p., ISBN 1-57851-837-7
11. Risikko, J.: *Intermediary Organizations and Collaboration Platforms Enabling Collaboration Between SME's*. University of Vaasa, Vaasa (2017)



Company Decision Factors While Choosing the Future Location for the Future Business

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Abstract. The competitive environment of the future is in a rapid change and companies have to reflect on their own competition and their own strategies. As one of the key issues enterprise has the choice of location, that supports the company's strategy and survival in future competition. In the future, the placement of companies will not be based on traditional industrial-age competition factors such as transport links, the extent of the customer base, the availability of raw materials or the availability of labor. The fourth transition period of industrial society re-evaluates the company's competitive factors. Key and simultaneous megatrends such as digitization and explosive growth in information, new technologies, climate change, urbanization, resource constraints, etc. also change traditional demand and supply balance and consumption habits. The business environment is complex and difficult to foresee, and for a single company the change cannot be clearly demonstrated. This article tries to highlight the factors that the company should focus on when designing its business and defining the location and establishment environment. In addition, the article looks at the factors that the company must take into account in the fourth transformation of industrial society. The article also provides a business-oriented perspective for the needs of regional development.

Keywords: Location · Ecosystems · Megatrends · Value network · Digitalization · Transdisciplinary · Co-innovation

1 Introduction

Since the 19th century, we are on the very first step of the greatest social and economic challenge. Global trends like climate change, geopolitical changes, natural resource depletion and the emergence of disruptive technological innovations are driving the transition to a systemic change. We need to understand this change that will fundamentally alter the way we manage, power and move our society [1].

The World Economic Forum report [2] has designated this period of accelerating innovation in science and technology – the transformative change in data and technology capabilities combined with a merging of digital, physical and biological realms and its consequences on society as the Fourth Industrial Revolution.

The technologies of the Fourth Industrial Revolution have generated enormous excitement about the opportunities they offer as well as concern about governance, regulation and ethics [2]. Enterprise - university partnerships has to be intense and main

objective should be a shared learning, in order to be successful on new opportunities of Industry 4.0 development [3]. 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 not to mention the actual exponential accumulation of data itself enterprises can have benefit on new opportunities and optimize existing operations to achieve significant business improvement [4].

In order to sustain competitive advantage, many companies developing more sustainable customer-engaging products, co-innovating sustainable services together with their partners, and collaborating to create integrated new sustainable business technologies [4]. Responsible leadership understood as a social-relational and ethical phenomenon, which occurs in social processes of interaction communication [5].

It is a strategic approach for companies to find a location and ecosystems, which are supporting the strategic goals of companies and the new trends in its business. According a nowadays megatrends it is important also to understand the movement towards new business locations and vital environments, which would provide the key elements for competitive edge of new business.

2 Theoretical Background

Finland is directed towards ecosystem-based development approach through various ministries. The national ambition is to be the foremost country in the exploitation of digitalization using of open data. Legislation supports open data approach so that it can integrated through application programming interfaces (API's). This is the way to create new business opportunities and new services. Digital ecosystem approach forces to create new strategy, relationships and value creation.

The dynamic business ecosystems can create partnerships with competitors. When there is interest to develop new technologies, they may join and then later have competition on the market. The groups such as a government, charity and a community group, in a less-competitive ecosystem, might collaborate on health or public policy because each entity has a shared interest and aim. "Digital business drives huge changes in organizations' business ecosystems, making them bigger, more complex and essential to strategy" [6].

Location Intelligence is a form of business intelligence where the dominant dimension used for analysis is location or geography [7]. Graf and Bandari [8] have introduced a model which provides a guidelines for companies and researchers to make a more systematic and comprehensive approach to outsourcing location decisions.

It is the management within the broader ecosystem, that will leverage fresh knowledge. Being able to apply context and domain expertise, worked through digital platforms and applied technology that focuses on co-creation, to deliver on the potential of new insights that are leading to innovation with a real difference. This collaborative "orchestration" will determine those that will emerge as winners within the Industrial environment as they form unique competitive edges based on reliance, trust, and deepening partnerships. The digital platform facilitates this but it is the value of the relationships that are connecting and exchanging value will decide the true winners and that requires ecosystem thinking [9].

With increased connectivity, organizations will need to figure out how to integrate things like smart advisors and artificial intelligence into their ecosystems. One need to understand that the diversity of an ecosystem and the roles that people, businesses and things play will change and evolve depending on the situation [6].

Industry 4.0 architecture takes account of the increased digitalization of various industries where physical objects are seamlessly integrated into the information network in the future [10]. Adapting Industry 4.0 framework as a basis for development activities is expected to provide an opportunity for remarkable competitive advantage for businesses but also for regions [11].

Nidumolu, Prahalad and Rangaswami [12] explain widely why sustainability is now the key driver of innovation. The biggest benefit comes from generating and processing big data. The huge amount of data generate problem of analyzing varied and dynamic datasets. The solution has been the development of new forms of data management and analytical techniques that rely on machine learning and new modes of visualization [13]. Conradie and Choenni [14] have recognized, that the most reliable method how to identify the datasets with big potential is a demand-based approach, which means a close cooperation with potential end users. Every participant in ecosystem has an opportunity to participate on creation of innovations and value, which generally is produced on the boundaries of ecosystem stakeholders [15]. Business ecosystem can be born as group activity or a single company can create it by collaborative activities [16]. Industrial symbiosis provides a means to improve competitiveness and build resilient and sustainable economies [17]. Industrial symbiosis helps businesses and organizations to operate in the same way as the natural eco-system where everything has a place and function, and nothing goes to waste. Industrial symbiosis engages diverse organizations in a network to foster eco-innovation and long-term culture change.

Creating and sharing understanding through the network yields mutually profitable operations for fresh sourcing of required. The general adoption of information and communication technology (ICT) is increasingly progressive the blurring of boundaries between the real physical world and the virtual one. The linkage is becoming increasingly Smart [18].

This “smartness” requires greater connection and cooperation. This is where the ‘explosion’ of platforms and ecosystems is occurring. Presently Industry 4.0 is more industrial driven but this will change and broaden out [19].

3 Research Questions and Research Approach

The business environment of the companies is changing because of megatrends, new technologies and business models, which will replace the traditional strengths. That forces companies/organizations develop new competitive edges in order to ensure future business.

The main research questions are:

- (a) How do the megatrends change future business towards ecosystem environment?
- (b) How will new technology change the importance of location (region) as a key competitive edge factor?

- (c) What is the functional model of the interface between companies and affiliates in ecosystem development?
- (d) What will ecosystem-based development approach provide for business innovations?

This article introduces a concept model for the future key factors for enterprise decision making. The article gives also a new approach for companies in decision making when choosing the location.

4 Megatrends and New Technology Will Change Traditional Strengths

The fourth transition period of industrial society re-evaluates competitive factors of a company. Key and simultaneous megatrends such as digitalization and explosive growth of information, new technologies, climate change, urbanization, resource constraints etc. also change traditional demand and supply balance and consumption habits. The business environment is complex and difficult to foresee, and for a single company the change cannot easily be demonstrated.

Traditionally companies are located close to their customer, close to raw materials, labor force, energy, place with good connections so that the value chain can be improved. One of the key sources criteria has been availability of skillful labor force.

Digitalization is one of the main megatrends, which will give its impact to the birth of new competitive edges and the old strengths lose importance. It can be described: (a) circular economy related will make resource efficiency circuit efficient, so there is no need to transport goods from far. (b) the new technologies as AR, VR, 3D, AI will change the need to move people or materials. (c) renewable energies will give new approach for climate warming, which support use of side flows for energy like biometanol, biogas etc. (d) Robotic and AI will replace skilful labor force in its traditional sense. (e) etc.

Based on the argument above, also the companies/organizations and business will look for new kind of development, how to choose their location. Similar kind of development has been seen in history before.

In historic framework first marketplaces were established on coasts, close to rivers, before railways were invented. Railway were developed through the key points of business activities The arrival of cars and highways attracted companies and businesses on highway crosses, urbanization and growth of aviation created “aviopolis” are coming hearths of business. In all these periods companies have been trying improve their value chains. On the historic perspective we can say that in present transition of digitalization, there will be new situation in business and companies are looking for new locations.

5 Competitiveness of Companies/Business

The main drivers for the change will be a huge amount of data, new technologies, which make it possible to know customer demand and expectations online. The challenge for future business will be the ability of a company to innovate new products and services and also bring them into global markets.

Organizations will need to find out, with increased connectivity, how to implement things like smart advisors and artificial intelligence into their ecosystems. It is essential to realize that the diversity of an ecosystem and the roles that people, businesses and things play, will change and develop depending on the situation [6].

Urbanization itself creates possibilities for new ecosystems and industrial symbiosis, which should be supported. (eg. the waste flows can be turned to new materials or energy; thus savings can be achieved in materials, energy and also in logistics.)

Cities will create new data from their own operating environment (made by tax payers' money), this collected data could be opened for everyone and thus make fundament for new business and start-up boosting.

Service development, which based is on data, needs also demonstration and pilot platform for quick trials in "real" environment (transdisciplinary). Towns with their ecosystems can create "real life" innovation, research, testing, and piloting environment, in order to make fast product/service development (Fig. 1).

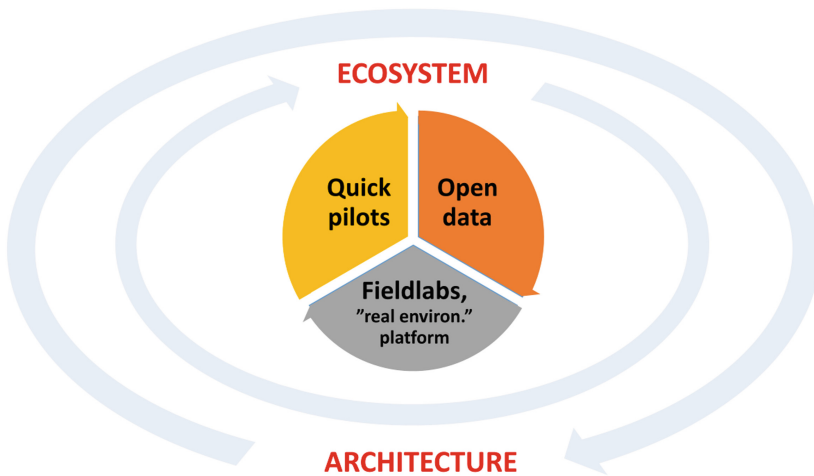


Fig. 1. The birth of innovation in digital ecosystem

When data flows, from different domains and from different real transdisciplinary environments are connected in an innovative way, it gives opportunity for the new innovation and new services. (eg. traffic data will be connected to health care data.)

The "right" environment includes real action and real customers and data produced in that environment. Entering new, tested and piloted product to global market requires "digital platform", so that all the participants in ecosystem are connected and they bring feedback information about markets. Industry 4.0 is framework is for this platform.

Private organizations are keen to use new technologies and they are trying to find the most suitable business environment and locations for them (Fig. 2). The task of the government, region and the town is not to make business, but to develop attractive and fruitful business environments for enterprises and build infrastructure for industry and society [3].

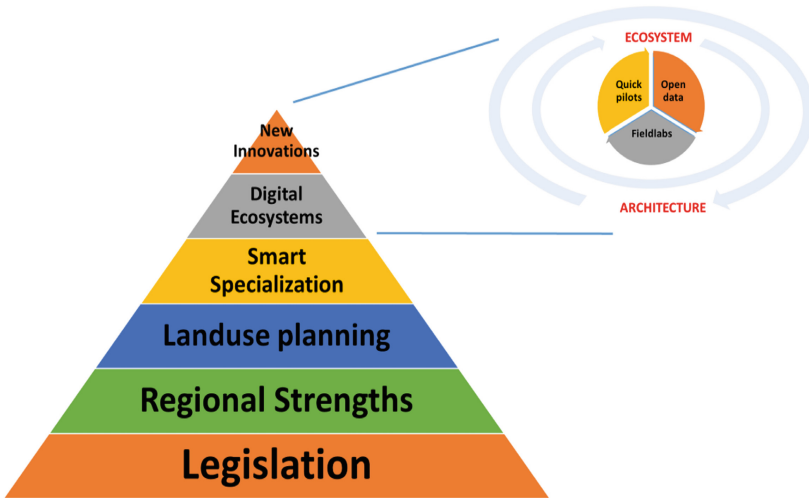


Fig. 2. Triangle of multilayered development

The development of business environments are generally seen to be the responsibility of public sector and the government. The public sector different levels (e.g. legislative-national- provincial- regional- municipal- areal). There are many actors and operations, which have the duty to develop business environment. All the levels and activities should be parallel and in the same line, support each other, and be sustainable in order to make the co-operative environment to perform best possible way. In rapidly changing operational environment, a clear and commonly understood vision is required [3].

Future location environments for companies are the ones, which make it possible to have fast product development and to scale product to global market. The key element in this development are ecosystems, architecture, and “fieldlab” environments.

Despite of the facts of development, there are not any reasons to underestimate the importance of regulation (legislation) or the traditional strengt or smart specialization development actions in a region.

6 Discussion and Conclusions

Megatrends, new technologies and the amount of data will change our business environment by changing the traditional fundamentals of business competitiveness. Parallel development in the history has been seen in transition periods during industrial time societies.

New technologies like AR, VR, AI, 3D technologies will change our understanding and need about traveling or logistics. Also urbanization and circular economy thinking change our understanding about raw material sources. Smart robots and AI will also change our understanding about skillful labor force etc. The trends of resource efficiency and digitalization are directing business models towards service business and service environments.

Key challenge for companies will be the ability to create quick customer driven innovations and the ability to scale products/services to global markets. This requires right/good ecosystems. Business ecosystems and industrial symbiosis should be seen as continuous developing entirety, which will change all the time and respond on the opportunities in technology and in business environment, and thus maintain their competitiveness.

Digitalization, data, new technology and industrial symbiosis are the key drivers, which will change the business environments, a way to act and create innovation. The location choosing decision are based on the vitality of business environment and location in long run. The future key elements for locations will be the vitality of digital business ecosystem and the “real life” testing, piloting, development platforms (transdisciplinary), were quick piloting with open data sources could be done.

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References

1. Rotmans, Industrial Policy for New Growth Areas and Entrepreneurial Ecosystems TEM 3/2017
2. Fourth Industrial Revolution for the Earth Series: Harnessing the Fourth Industrial Revolution for Life on Land-Towards an Inclusive Bio-Economy. World Economic Forum, January 2018, Geneva, Switzerland (2018)
3. Ruohomaa, H., Mäntyneva, M., Salminen, V.: Renewing a university to support smart manufacturing within a region. In: Digital Transformation in Smart Manufacturing-Book, Chap. 8, InTech-Open Science|Open minds (2018)
4. 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)
5. Responsive and Responsible Leadership: World Economic Forum Workshop, Davos-Klosters, Switzerland, 17–20 January 2017 (2017)
6. Dimensions of Business Ecosystems. <https://www.gartner.com/smarterwithgartner/8-dimensions-of-business-ecosystems/>
7. 2019 Location Intelligence Market Study Report, Wisdom of Crowd Series, Dresner Advisory Services, 31 January 2019
8. Graf, M., Mudambi, S.: The outsourcing of IT-enabled business processes: a conceptual model of the location decision. *J. Int. Manag.* **11**(2), 253–268 (2005)
9. The Emerging World of Connected Industrial Ecosystems, 10 January 2018 by @paul4innovating
10. European parliament, briefing: 4.0 Industry digitalization for productivity and growth, September 2015. <http://www.europarl.europa.eu/thinktank>
11. Ruohomaa, H., Kantola, J., Salminen, V.: Value Network Development in Industry 4.0 Environment. In: Advances in Human Factors, Business Management and Leadership. Springer International Publishing AG, Cham (2018)
12. Nidumolu, R., Prahalad, C.K., Rangaswami, M.R.: Why sustainability is now the key driver of innovation. *Harvard Bus. Rev.* **87**(9), 56–64 (2009)

13. Kitchin, R.: Big Data, new epistemologies and paradigm shifts. *Big Data Soc.* **1**(1), 10 (2014)
14. Conradie, P., Choenni, S.: On the barriers for local government releasing open data. *Gov. Inf. Quart.* **31**(Suppl. 1), S10–S17 (2014). <https://www.researchgate.net/publication/261989071>. Accessed 17 Feb 2017 (1 Mar 2018)
15. Iansiti, M., Levien, R.: *The Keystone Advantage: What the New Dynamics of Business Ecosystems Mean for Strategy, Innovation, and Sustainability*. Harvard Business School Press, Boston (2004)
16. Järvi, K.: *Ecosystem architecture design: endogenous and exogenous structural properties*. Dissertation, Lappeenranta University of Technology, Lappeenranta (2013)
17. Lombardi, R., Laybourn, P.: Redefining Industrial Symbiosis. *J. Ind. Ecol.* **16**(1), 28–37 (2012)
18. Deloitte: *Industry 4.0 challenge: challenges and solutions for the digital transformation and use of exponential technologies* (2015)
19. PwC: *4.0 Industry: building the digital enterprise*. Global Industry Survey (2016)



Ecosystem-Based Development on Managing Digital Transformation

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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. As a nation, Finland is adopting an ecosystem approach to resource-efficient orientation, avoiding mutual competition and increasing rapid innovation activity. Agile implementation of new issues is essential in different ministries. The national goal is to be the leading country in the exploitation of digitalization. Cities are responding to the rapid development of society and are moving from traditional organizational structures to ecosystem development and 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 transition to ecosystem-based development of the Hämeenlinna city on the Finnish Growth Corridor.

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

1 Introduction

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.

To keep competitive edge town and regions are forced to review their visions and strategies. This way leaders are extending their value proposition multidimensional by creating strong engaging environment, co-innovating and collaborating with their partner and this way to create integrated new attractive business environments and services for inhabitants. Increasing complexity challenge organizations to execute profitability in continuous change of new technology.

OECD Recommendation on Digital Government Strategies [1] outlines the political imperative for improving the efficiency, effectiveness and governance of public services design and delivery through digitalization.

The move towards new ICT based technologies will happen unexpected fast including exponential growth of data. That is the reason why it is essential to understand the challenges of change and have strategic view, identify the key elements and see the new opportunities in all level of society development. Increasing complexity needs new approach on organization structure, but also education and research in order to manage fast change and ensure the best possible implementation.

This article describes ecosystem-based development at Hameenlinna town, by using its strengths, but also learning new skills. Objectives are to improve the competitiveness and vitality its business environment and town services as well.

2 Theoretical Background

New technology will change the business environment and society in order to be able to safe scarce resources, manage fast change, make better innovations and have proper implementation, so there will be need for new kind of organization structures.

As a nation, Finland is adopting an ecosystem approach to resource-efficient orientation, avoiding mutual competition and increasing rapid innovation activity. Agile implementation of new issues is essential in all businesses. The national goal is to be the first country in the exploitation of digitalization. It is necessary to think about strategy, relationships and value networks when building up digital ecosystems.

The business ecosystems may facilitate partnerships also with competitors. When there is interest to develop key technologies, they may join together and then later compete in the market. In a less-competitive ecosystem, groups such as a government, charity and a community group might collaborate on health or public policy because each entity has a shared interest and goal.

Digital business drives dramatic changes in organizations' business ecosystems, making them larger, more complex and essential to strategy [2].

It is the management within the broader ecosystem, that will leverage fresh knowledge. Being able to apply context and domain expertise, worked through digital platforms and applied technology that focuses on co-creation, to deliver on the potential of new insights that are leading to innovation with a real difference. This collaborative "orchestration" will determine those that will emerge as winners within the industrial environment as they form unique competitive edges based on reliance, trust, and deepening partnerships. The digital platform facilitates this but it is the value of the relationships that are connecting and exchanging value will decide the true winners and that requires ecosystem thinking [3].

OECD report [1] outlines a systematic and consistent approach to achieving sustained public sector productivity improvements and more user-driven public services is required [1].

Industry 4.0 describes the organization of processes based on technology and devices autonomously communicating with each other along the value chain [4]. Industry 4.0 architecture takes account of the increased digitalization of various industries where physical objects are seamlessly integrated into the information network, allowing for decentralized production and real-time adaptation in the future [4].

Industry 4.0 is an umbrella term characterising digitization and integration of the whole industrial value chain [5].

Adapting Industry 4.0 framework as a basis for development activities is expected to provide an opportunity for remarkable competitive advantage for businesses but also for regions [6].

Innovation performance of an economy depends on how institutions/companies interact with each other as elements of a collective system of knowledge creation and use, and on their interplay with social institutions (such as legislation, norms and values) [7]. Keeble and Wever [8] have introduced their concept on how to create new firms during continuous regional development.

Emerging service ecosystems are fuelled by interconnecting service systems and digital technologies [9]. Miller and Langdon [10] introduce how to manage disruptive innovation by managing platform, product and process innovation in continuous cycles. It is important to see the world as a complex system and it must be understood that it is impossible to change one thing alone as everything is connected to something else [11]. The business ecosystem produces goods and services of value to customers, who are themselves members of the ecosystem. The member organisms also include suppliers, lead producers, competitors, and other stakeholders [12].

Every participant in ecosystem has an opportunity to participate on creation of innovations and value, which generally is produced on the boundaries of ecosystem stakeholders [13]. Business ecosystem can be born as group activity or a single company can create it by collaborative activities [14]. Co-evolution between companies, cities, and universities bring solution to tackle on development activities together. It is possible to learn from each other, use best resources available and work together fast enough and resourcewise way on open and common platforms [15].

3 Research Questions

The importance of new technology, for the society, will continuously be more important, because of the availability and quality of services for inhabitants, but also based on expenses. The cities are needed to have a clear vision for development and organizational structure to manage fast change and continuous development work.

The main research of discussion are:

- (1) Does digital transition lead to ecosystem-based development process
- (2) Are there differences on private or public sector-based ecosystem development?
- (3) How innovation and service network is constructing transdisciplinary ecosystem.
- (4) How Industry 4.0 as business architecture is supporting the development of business-based ecosystem.

This article describe ecosystem-based development concept. Case study concentrates on Hämeenlinna city ecosystem environment; It provides an approach for new technology to bring a transition and coevolution on society.

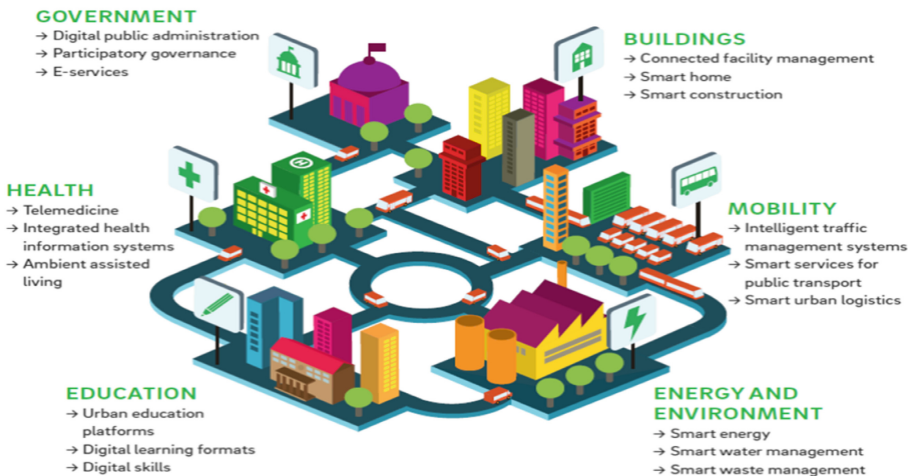
4 Management of Change in Multidisciplinary and Co-operative Environment in Smart City Development Work

Digitalization and new technology change traditional business environment and is a big opportunity to find out competitive advantage in new business. Universities and educators have a good opportunity and central task in supporting the growth of business on the area of digitalization and ecosystem-based development. The co-operation between enterprise and universities and government, is important to succeed in co-evolution when building up cumulative knowhow in creation of solutions for digitalization by benefiting digitalization in it. It is also important to have a common vision and commitment to direct the local authorities and funding. Otherwise, the activities can splinter as small pieces.

Organization exists in multiple business ecosystems (Fig. 1). These business ecosystems are dynamic networks of entities communicating with each other to create value for participants. The challenge is deciding how your organization will survive and thrive in its ecosystem. The degree of openness within ecosystems is managed by strategies, common goals and shared interest. An ecosystem may be hybrid, private or public. Organizations often participate in a hybrid of public and private ecosystems [2].

THE WHOLE IS GREATER THAN THE SUM OF THE PARTS

An ideal smart city strategy covers six interrelated action fields, comprising a host of subcategories and solutions



Source: Roland Berger

Fig. 1. Cities have many ecosystems around it (Source Ronald Berger)

One approach on the development of the ecosystems is co-evolution; where ecosystem member organizations or parts of the ecosystem evolve in alignment. An example of co-evolution is a *Digital Ecosystem* and a Business Ecosystem evolution, which Moore (2003) introduces as the *Digital Business Ecosystem (DBE)* [16].

Ecosystems can co-evolve in a structural level in addition to species, roles and functions.

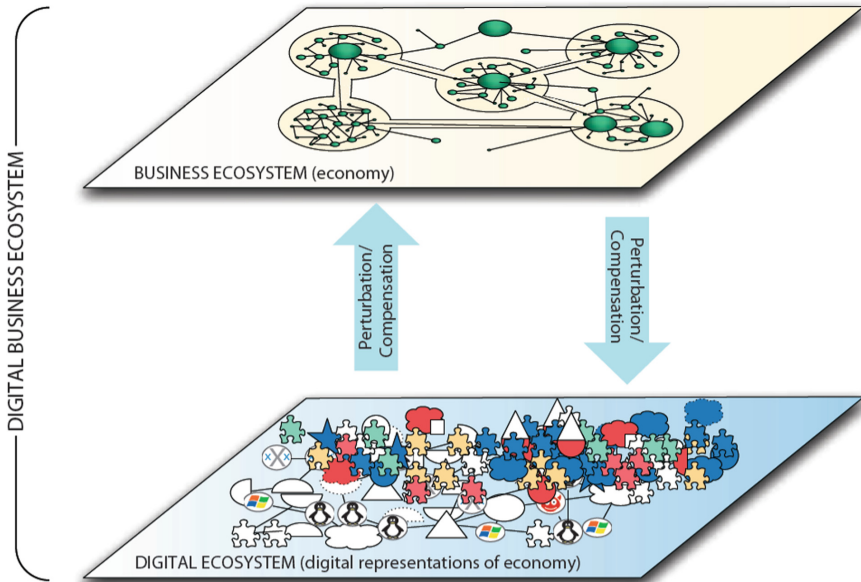


Fig. 2. Digital Business Ecosystem (DBE Book, 2007)

Figure 2 illustrates a Digital Business Ecosystem structure where the business ecosystem and digital ecosystem are coupled to form a viable dynamic innovation ecosystem. The digital ecosystem influences enterprises, their social and business networks, and the business ecosystem affects the organisms of the digital ecosystem [16].

Industry 4.0 can be seen as a framework for regional development [6]. In the field of social change, there is little awareness of Industry 4.0 outside the group of key stakeholders [4]. New ICT-related technologies make Industry 4.0 development possible and give opportunities to re-engineer value chains and create new business models. The growth of connections brings the new possibilities and solutions for the business. The exponential growth of data brings also new challenges and indicates the birth of a new kind of business models [17]. This “smartness” requires greater connection and collaborations. This is where the explosion of platforms and ecosystems is occurring [18].

5 Conceptual Model for Ecosystem-Based Development

Cities are responding to the rapid development of society and are moving from traditional organizational structures to ecosystem development and building their own network to develop operations.

Fruitful cooperation requires common understanding and commitment. It requires also information and experience sharing. Cooperation has to happen on different levels operation, e.g. forecasting and roadmap projects, development and research projects, developing learning environment for piloting and experimentation. All organization levels cooperation should be continuous process. Co-operation and learning together on real life environment is basis for innovations and continuous development. It is important to understand open information sharing and the benefits of multidisciplinary competence.

Figure 3 describes the implementation model of development towards ecosystem-based development process at Hämeenlinna city by benefiting value chain management, proper digitalization and data analysis/management. The key focus areas of development on increasing vitality of city area are future manufacturing, bioeconomy, smart services, tourism and events and smart town. The aim of digitalization is to increase effectiveness on planning and optimization. The objective of using and involving value partners is to support effectiveness of leadership and organization.

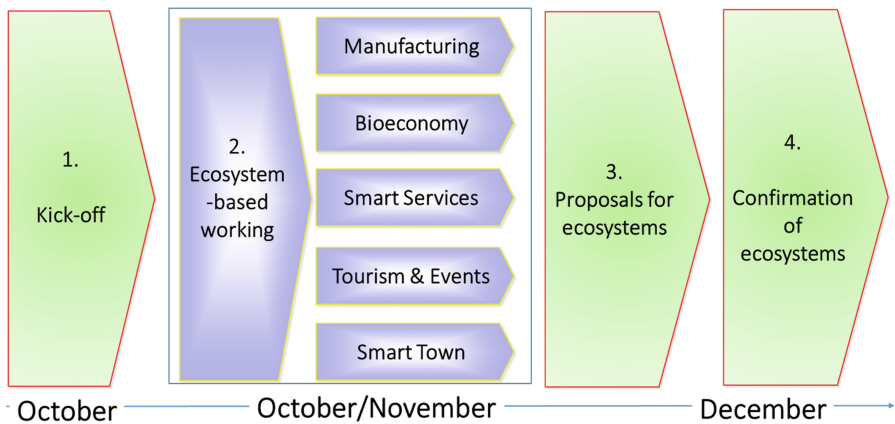


Fig. 3. Proper implementation of ecosystem-based developing in Hämeenlinna town

There have to be understanding about content and the process knowledge of customer site when applied research is been made. There have to right attitude and suitable skills to work in teams on distributed way with other experts in order to able to make valuable networks [15].

6 Applying Ecosystem Based Development in Hämeenlinna Town

While cities largely receive their own funding as taxes, in that case 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.

Hämeenlinna town is developing its strengths and competitiveness according to its own strategy based on ecosystem-based development. Because of the vision and strategy, the authorities of town are motivated on long term development related to the implementation of ecosystem-based development in the given focus areas.

The development activities by Smart Service - research centre have been linked according to “Industry 4.0” framework to ensure compatibility. At this moment “industry 4.0” gives more framework for development than given accurate orders or rules.

Industry 4.0 and digitalization can also be seen to attract new business to town. To ensure the implementation it is important to have an innovative atmosphere, so that customers/inhabitants/employees will join to the development and innovation activities. By engaging stakeholders, we can achieve more willingness to change, more commitment, opportunities for new ideas and start-ups. The development work will be done in the “real life” environments (factories, offices, hospitals etc.) by quick pilots (Fig. 4).

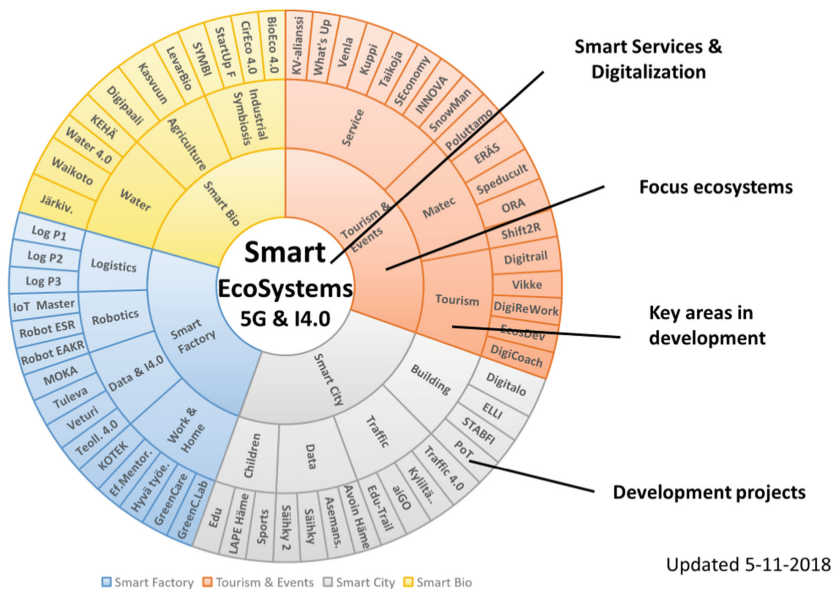


Fig. 4. “The circle of Ecosystem-based development” in Hämeenlinna town by Smart Service - research centre at HAMK

The utilization of new ICT-based technologies requires new technical and multi-disciplinary skills.

Education and reeducation are reducing resistance to change, speeding the implementation, and supporting the positive attitude to change, by building versatile knowledge. When education will take place in “real life” environment by pilots and quick trials, education is also fundament for innovation. Hämeenlinna town itself is willing to be the “real life” environment and that way provide platform for innovations and start-ups (Fig. 5).

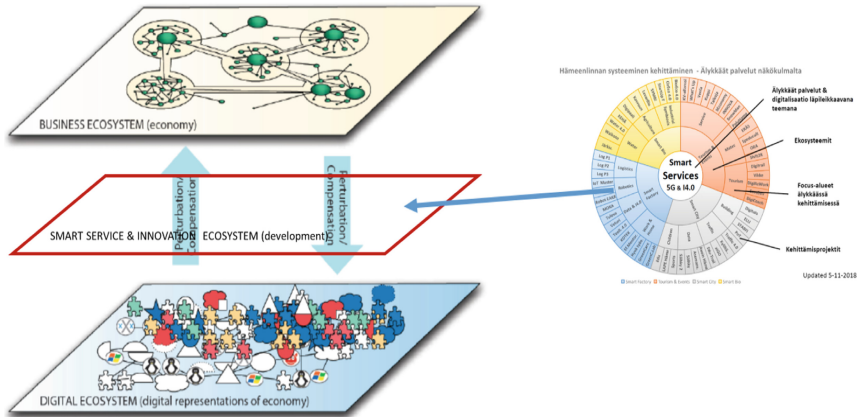


Fig. 5. Research centre connect digitally to stakeholders inside ecosystems, but also connect ecosystems to each other's

Smart Research-centre can so seem to be an important stakeholder in all ecosystem in Hämeenlinna, but it can also seem that Smart Research-centre is the key element that connect the ecosystem to each other and thus make fundament for the new innovations, which takes place on the interfaces of different ecosystems.

7 Discussion and Conclusions

The ecosystem-based development plans of Hämeenlinna town has been analyzed in this article. The analysis describe, how Hämeenlinna is trying to respond the challenge of digitalization and develop its own competitiveness and regional vitality. It has to manage fast change and also attract new business and inhabitants on the region.

The main idea, behind this article, has been also to understand the principles of industry 4.0 framework and digitalization on the ecosystem-based development on value network thinking. The town has created vision, objectives and focus areas commitment for long term development based on the smart specialization strategy.

The town has indicated in its ecosystem-based strategy the vision, intension and guidelines to all stakeholders. I has invited all stakeholders to common development work. To ensure the implementation of ecosystem-based development, the needed efforts will be made visible in all focus areas by having “a real life” environment pilots and quick trials. Hämeenlinna town ecosystem development work has deepened to relationship with municipality, industry, university and whole society.

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References

1. OECD Comparative Studies Report- Digital Government Strategies for Transforming Public Services in the Welfare Areas (2016). <http://www.oecd.org/gov/digital-government/Digital-Government-Strategies-Welfare-Service.pdf>. Accessed 3 Mar 2018
2. Dimensions of Business Ecosystems. <https://www.gartner.com/smarterwithgartner/8-dimensions-of-business-ecosystems/>
3. The Emerging World of Connected Industrial Ecosystems, 10 January 2018 by @paul4innovating
4. European Parliament, Briefing: 4.0 Industry digitalization for productivity and growth, September 2015. <http://www.europarl.europa.eu/thinktank>
5. Deloitte: Industry 4.0 challenge: challenges and solutions for the digital transformation and use of exponential technologies (2015)
6. Ruohomaa, H., Mäntyneva, M., Salminen, V.: Renewing a university to support smart manufacturing within a region. In: Digital Transformation in Smart Manufacturing-Book, Chapter 8. InTech-Open Science|Open minds (2018)
7. Clarke, T., Chelliah, J., Pattinson, E.: National innovation systems in the Asia Pacific: a comparative analysis (2018)
8. Keeble, D., Wever, E.: New Firms and Regional Development in Europe. Routledge, Abingdon (2016)
9. Lusch, F.R., Vargo, S.L., Gustafsson, A.: Fostering trans-disciplinary perspectives of service ecosystems. *J. Bus. Res.* **69**, 2957–2963 (2016)
10. Miller, W., Langdon, M.: Fourth Generation R&D: Managing Knowledge, Technology, and Innovation. Wiley, Canada (1999)
11. Sterman J.: Business Dynamics: Systems Thinking and Modeling for a Complex World. The McGraw-Hill Companies, Inc., New York (2000)
12. Moore, James F.: The Death of Competition: Leadership & Strategy in the Age of Business Ecosystems. HarperBusiness, New York (1996). ISBN 0-88730-850-3
13. Iansiti, M., Levien, R.: The Keystone Advantage: What the New Dynamics of Business Ecosystems Mean for Strategy, Innovation, and Sustainability. Harvard Business School Press, Boston (2004)
14. Järvi, K.: Ecosystem architecture design: endogenous and exogenous structural properties. Dissertation, Lappeenranta University of Technology, Lappeenranta (2013)
15. Kukkamäki, J., Ruohomaa, H., Salminen, V.: Development of ICT education in digitalizing business environment. In: 5th international Conference on Quality and Innovation in Engineering and Management- ICPR-AEM, 25th–26th July 2018, Club-Napoca, Romania (2018)
16. Innovation Ecosystems Initiative. <http://www.digital-ecosystems.org>
17. Ruohomaa, H., Kantola, J., Salminen, V.: Value network development in industry 4.0 environment. In: Advances in Human Factors, Business Management and Leadership. Springer, Cham (2018)
18. PwC Report: 4.0 Industry: building the digital enterprise. Global Industry Survey (2016)



A Model for Capturing Tacit Knowledge in Enterprises

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Abstract. The recognition for tacit knowledge started in the early sixties and since then companies and enterprises have been trying to acquire this important type of knowledge to help them in decision making, support innovation, create value, and thrive. Researchers have developed tools like interviewing with valuable knowledge holders (experts) or storytelling techniques to help in acquiring, codifying, and sharing information, knowledge and making processes better. This paper presents a new holistic concept and model to integrate artificial intelligence applications for knowledge creation and retention. The model presented is called the Intelligent Model for Acquiring and Retrieving Knowledge (I-MARK). Integrating the artificial intelligence tools in knowledge management applications for internal use in enterprises will advance the skills, capability, and competence of organizational learning and support slow, inaccurate and fuzzy way working human brains to be more proficient and accurate in solving problems and decision making.

Keywords: Knowledge management · Tacit knowledge · Natural language processing · Human-computer interaction

1 Introduction

Language is the most significant discovery the human mind has ever known. Our knowledge has grown enormously since then based on that ability to express and share what we learned while observing or through experiences. Using language to support human mind functions has led to a better understanding of our surroundings and faster learning processes and storing what we know in a written form helped to transfer that knowledge through generations. It has been discussed and scientifically proven that a baby in its first year is like a chimpanzee with the same age, before learning how to use language to interpret and connect with other minds and have his own interpreted ideas. Without the language, a full-grown human cannot practice thinking or innovations. Words can help us imagine what we cannot see. Even when we do not speak, the thoughts in the unconscious mind are formed from languages we developed from interacting with society. With language availability, the need to organize what we know

has raised, philosophers and scientists have always related to knowledge as justified truths from beliefs and experiences.

Late in the 1950s scientists tried to build systems that could understand our natural languages (i.e. English, French, Arabic) one the earliest successful programs was SHRDLU, in M.I.T labs that could move blocks by making a dialogue with the program. Today, Natural language processing (NLP), part of Artificial intelligence (AI) subcategory, has hundreds of applications from machine translation to conversational agents. Conversational agents, also known as Question & answering systems, have been integrated into many enterprises to respond to queries from customers mainly to provide better customer service or support feedback systems and surveys. It can also have the ability to perform some actions with the right credentials.

1.1 Forms of Knowledge

The questions that matter in any workplace are What do you have to know, and how do you need to know it, to make decisions and do your work? When we talk about classifying knowledge based on how accessible, refined, and structured, there are two basic forms of knowledge: Tacit Knowledge, the unrefined, unstructured and not directly accessible and Explicit Knowledge, highly refined, structured, that can be directly accessed. Tacit Knowledge is basically in the mind of knowledgeable people, it carries the values and judgments, can be precepted in applied skills, capabilities, competencies and habits. Most of Tacit Knowledge is practiced non-consciously where one cannot tell all the reasons and motivations behind his/her decisions. The Explicit Knowledge on the other hand, is known to be presented first in explicit form in media (i.e. books, documents, videos). It needs therefore describable passive and active learning to be captured into human brains. It is then in the beginning data or information that turns through human perception and understanding into human knowledge.

1.2 Types of Knowledge

Knowledge was categorized through different classification. In 1993, Wiig [1] offered four types of knowledge arranged according to complexity, increasing abstraction, and aggregation. These are Factual, Conceptual, Expectational, and Methodological. Factual Knowledge is meanly proved chunks of information. Conceptual Knowledge is concepts and perspectives based on available facts and data. It is the views towards complex situations. Expectational Knowledge is linked with experiences, it is the expectations and hypothesizes with cognitive involvement. Methodological Knowledge approaches thinking and reasoning states in different contexts and strategies for problem-solving or forecasting goals.

Looking to the dimensions of Wisdom Cube by Vanharanta and Markopoulos (see Fig. 1) [2] where Aristotle's work on knowledge and wisdom, technical knowledge (Methodological) and theoretical knowledge (Conceptual) scientific knowledge (Factual) and practical knowledge (Expectational) have taken a place and emerged, and how these knowledge flow consciously and unconsciously in the workplace on the individual level and will be reflected on the organizational level (i.e. project management), yet this knowledge will not necessarily be stored in the organizational

memory and when individuals leave for different reasons the company lose the tacit part of this knowledge.

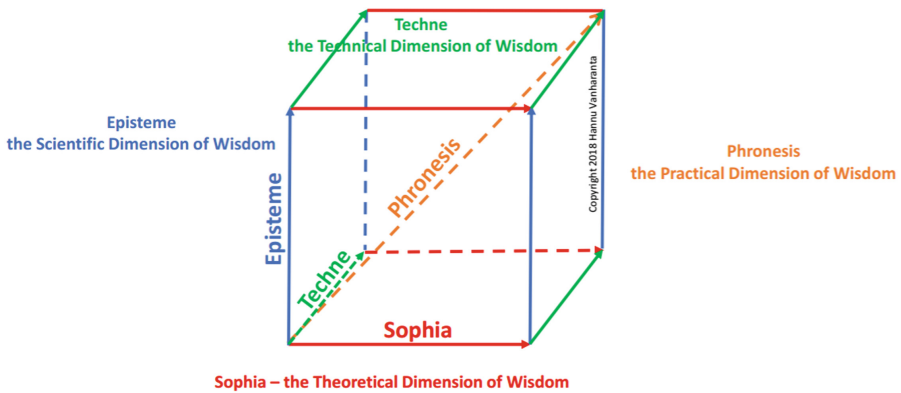


Fig. 1. Wisdom Cube [2]

1.3 Importance of Storytelling

Storytelling is a rich source of tacit knowledge and humans are storytellers by nature, they tell stories every day and, in every story, there are some chunks of knowledge hidden between the lines. Stories contain values, experiences and lessons learned from professional careers and events. In an experiment conducted by Whyte and Classen [3] to confirm the usefulness of the storytelling practices in enterprises, project and personal stories were among the highest type of stories that were shared and proved that scripting stories can bring many benefits to the enterprises.

1.4 Interview Techniques

Interviewing sessions have many styles and the interviewer should have specific skills to make the sessions more efficient. The interviewee (i.e. expert) must also have specific skills in order to tell what they know.

Interviews as a tool to capture tacit knowledge is another way to seek information and knowledge with a prepared list of questions (i.e. open questions or closed questions).

1.5 Challenges and the Need for Smart Systems in Knowledge Retention

The challenges in these two techniques are that although employees can be trained to practice them, bias based on age or race or gender can happen during the face to face sessions and affect the quality of knowledge. Misunderstanding is also an obstacle that arises and makes barriers against interpreting the knowledge correctly to codify it. Confidentiality of information is another challenge in the era of digitalizing business to

keep information secure and prevent any unauthorized access to knowledge resources inside any enterprise.

“To improve, we must continually acquire and create new knowledge – we must learn –and put it to use! This applies equally to us as individuals and to our organizations” (Wiig [1], p. 180). It has been questioned how we bring all levels of the enterprises to interact with knowledge in a dynamic way? Encouraging everyone to contribute what they know and support other’s progress to grow? How we know the best knowledge and spread it for better performances? How we make our knowledge complete.

2 I-MARK Model

2.1 General Description

I-MARK Model (see Fig. 2) has three main components that work together to support the user either to retrieve knowledge or to acquire knowledge. The first component is Human-Computer-Interaction (HCI), the interface to the system where machine learning and natural language processing are used to generate text from data (cf. Natural language generation) and be able to understand (cf. Natural language understanding) – metaphorically for the ability to take actions based on the context or reuse this information or knowledge – human language to make successful interview sessions or to response to questions being asked. The second component is the database where information and chunks of knowledge that were collected successfully in interviews sessions are stored. I-MARK has two types of databases; the typical databases and knowledge bases, in the next pages these two types will be briefly explained. The third main component is Knowledge discovery in databases (KDD), it works to discover the patterns and information are insightful.

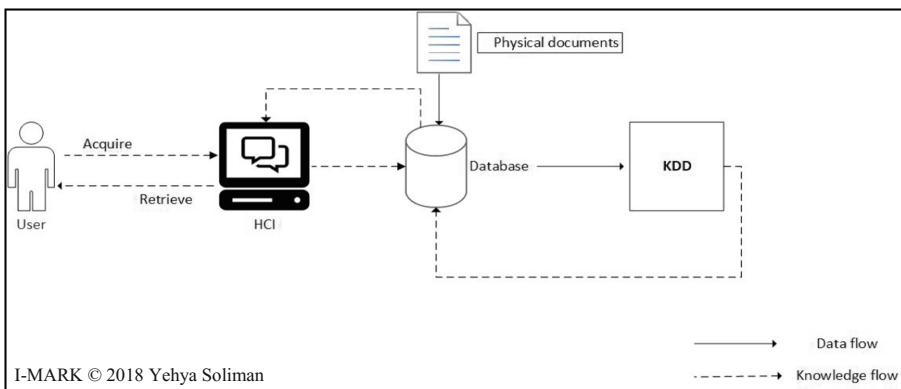


Fig. 2. I-MARK Model

2.2 The User

The model meant for all members of any enterprise. Wiig [1] categorized the proficiency level of employees into seven levels based on what they know and how they perform in their enterprises and how they can contribute to Enterprises knowledge (Fig. 3). All levels from ignorant (totally unaware) to grandmaster (who has the wisdom) need to have access to the knowledge they need, either to learn and practice the knowledge or to update their knowledge [4]. The seven levels of employees according to Wiig are:

1. Ignorant: Totally Unaware. Does not know that he does not know.
2. Beginner: Narrow awareness, little knowledge and unskilled.
3. Advanced beginner: Aware of the knowledge, incompetent but have developed skills cannot work alone.
4. Competent performer: Developed more understanding and can sort out certain tasks alone in narrow areas of knowledge.
5. Proficient performer: Knowledgeable with high skills and experiences.
6. Expert: Highly proficient in certain areas and know about other areas, can provide leadership.
7. Master: Highly expert in many areas and can teach about many domains.
8. Grandmaster: Master with wide recognition, have the wisdom.

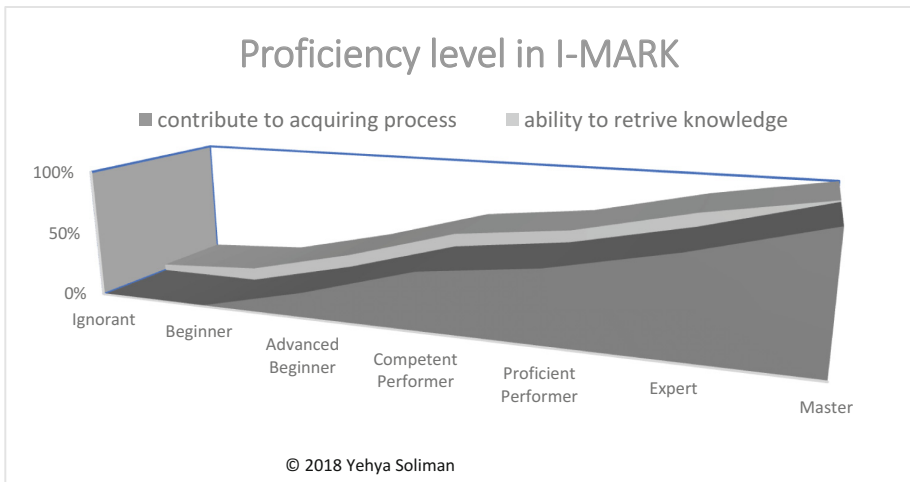


Fig. 3. Proficiency level in I-MARK Source: [4]

2.3 HCI

I-MARK aims to use the conversational agent's ability to respond to human languages and store and retrieve data to make sessions with different management levels to acquire knowledge and ask questions to fill certain gaps or deficiency in the enterprise's

knowledgebase. Simulating the interview techniques with I-MARK can prevent biases that can occur and affect the quality of shared knowledge during the sessions. Bias based on race, age or gender is one of the challenges for a successful interview. It will reduce the chances of misunderstanding because of ambiguous words as the system can have the ability to match different words with the same meaning to make it easier to recall this chunk of knowledge with synonyms.

2.4 Databases

There are two types of databases in the I-MARK model, the typical database, and knowledgebase:

- (1) The typical database that has data stored and categorized (mainly rows and columns and mostly quantitative, but not limited to that type only)
- (2) Knowledgebase that contains information and knowledge in many forms (i.e. documents, Q&A, media) organized in wider relations and linked with more than one category.

Reports, training manuals, and prepared knowledge repositories are considered as a passive way of communication to transfer knowledge. Some of these repositories are stored in knowledge base systems. I-MARK can transform these documents into a more active state through machine comprehension and natural language understanding. Typical databases main purpose in the model is to support the KDD component in the model for new insights and explicit knowledge to be stored in Knowledge bases for retrieval.

2.5 Methods

The model should be implemented with the support of some AI algorithms that will support the preferred results and integrate with enterprises' systems: Machine comprehension: AI tools that answer natural languages questions from particular text or document [5, 6]. Generating questions: Supervised learning for automatic generating questions [7, 8].

KDD processes: [9, 10] (see Fig. 4)

1. Selection: Data are set for cleaning to remove noise and unreliable data.
2. Processing: Exporting relevant datasets to the task.
3. Transformation: A stage where data will be transformed to appropriate forms for mining.
4. Data mining: Searching for patterns in data.
5. Interpretation: Reviewing the patterns to see what is important to the task and record the results/refine the model to find better/different patterns.

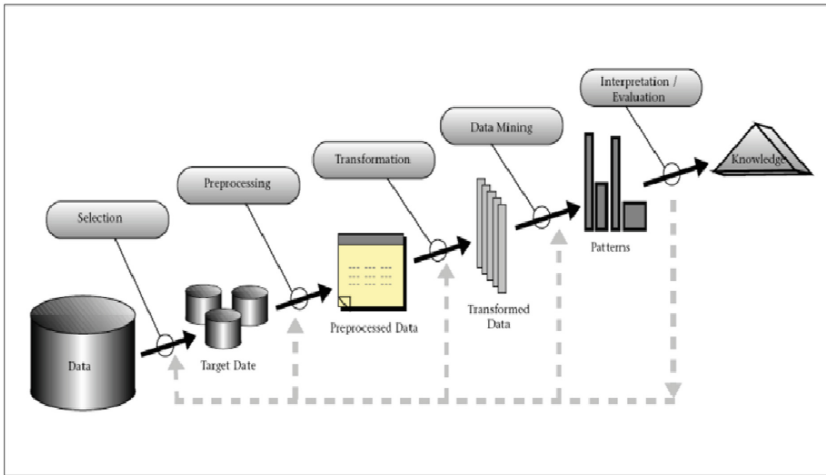


Fig. 4. KDD Model Source: [9]

3 Conclusion and Further Research

I-MARK can be a livable element in the enterprise that will learn fast and help new hire or people moving to a new role to gain knowledge faster. It can save time asking repetitive questions and release experts from answering the same question repeatedly about the processes or the best practices. It can reduce the daily emails sent.

The “mix of disciplines” that can release the tightness with problem-solving and allow mutual benefits. Integrating KDD processes in this model will boost the understanding of the acquired knowledge chunks in machine learning algorithms. Moreover, it will support experts and masters to create new knowledge that will be acquired again in a circular process.

I-MARK can also overcome the challenges of keeping knowledge updated and useful by setting an expiration date for a topic to be discussed and reviewed in the next sessions to validate the information in the database or update it.

References

1. Wiig, K.: Knowledge Management Foundations: Thinking about Thinking - How People and Organizations Represent, Create, and Use Knowledge, January 1993
2. Vanharanta, H., Markopoulos, E.: Visualization of the Wisdom Cube. AHFE 2019 (2019)
3. Whyte, G., Classen, S.: Using storytelling to elicit tacit knowledge from SMEs. *J. Knowl. Manag.* **16**(6), 950–962 (2012)
4. Soliman, Y., Vanharanta, H.: Capturing tacit knowledge using conversational agents. In: *Agile Systems and Entrepreneurial Behaviour: Monograph*, pp. 58–65. Poznan University of Technology (2018). ISBN 9788364249990
5. Seo, M., Kembhavi, A., Farhadiand, A., Hajishirzi, H.: Bi-directional attention flow for machine comprehension (2016)

6. Wang, H., Bansal, M., Gimpel, K., McAllester, D.: Machine comprehension with syntax, frames, and semantics. In: Proceedings of the 53rd Annual Meeting of the Association for Computational Linguistics and the 7th International Joint Conference on Natural Language Processing, 2015
7. Liu, M., Calvo, R.A., Rus, V.: Automatic question generation for literature review writing support. *Lect. Notes Comput. Sci. (including Subser. Lect. Notes Artif. Intell. Lect. Notes Bioinformatics)*, vol. 6094 LNCS, no. PART 1, pp. 45–54 (2010)
8. Bednarik, L., Kovács, L.: Implementation and assessment of the automatic question generation module. In: 3rd IEEE International Conference on Cognitive Infocommunications (CogInfoCom), pp. 687–690 (2012)
9. Fayyad, U., Uthurusamy, R.: Data mining and knowledge discovery in databases. *Commun. ACM* **39**(11), 24–26 (1996)
10. Dunkel, B., Soparkar, N., Szaroand, J., Uthurusamy, R.: Systems for KDD: from concepts to practice. *Futur. Gener. Comput. Syst.* **13**(2–3), 231–242 (1997)



Responsibility Caps from Strategy to Operations in Leadership and Management – Conceptual Model

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Abstract. Major scale strategy transitions seems to fail in most cases. Former researches shows that there has been large amounts of efforts to develop and study strategy formulation, but strategy implementation has been left with minor interest. This article focuses to strategy implementation from obstacles perspective. Article binds obstacles, actions and phases in strategy implementation to one holistic concept and provides ground for future research. Approach is integrating leadership, management and time management matters to change management in strategy implementation. Article highlights the responsibilities of top and middle management.

Keywords: Change management · Strategy · Implementation · Obstacles · Responsibility

1 Introduction

Reason for this paper is author's recognition that following story often describes the situation in organizations and especially in case of major changes. The story is called to four people named Everybody, Somebody, Anybody and Nobody, and it is told in many different organization development events around the world. *"There was an important job to be done and Everybody was sure that Somebody would do it. Anybody could have done it, but Nobody did it. Somebody got angry about that, because it was Everybody's job. Everybody thought Anybody could do it, but Nobody realized that Everybody would not do it. It ended up that Everybody blamed Somebody when Nobody did what Anybody could have."* It is good and amusing story, and it contains great pieces of wisdom. It describes the situation of gaps of responsibility between actors and belief that there is something, that anybody could do and therefore it is not interesting thing to do. This seems to be also the story of strategy implementation. Even that there is solid proves that meant strategy transitions are rarely successful by the implementation failures, this issue is less studied than strategy formulation i.e. not interesting to do.

2 Strategy

The term strategy is probably one of the most used words in management domain. It also is probably one of the most abused one. Many leaders and followers has been in the situation where discussion has been roaming around strategy formulation or implementation but there has not been common picture on which the discussion actually is meaning. Strategy is defined with many different ways in different domains. In Game Theory, strategy represents the set of rules that is to govern the actions of the players. In military domain, strategy is defined by von Clausewitz [1] to *“the employment of battles to gain the end of war”* or by Liddell Hart to *“the art of distributing and applying military means to fulfill the ends of policy”* [2]. These definitions are pointing to same direction as the latter made definitions in management domain.

Chandler defined strategy to *“the determination of the basic long-term goals and objectives of an enterprise, and the adoption of courses of action and the allocation of resources necessary for carrying out these goals”* [3]. Mintzberg [4] pointed that strategies are formulated to set direction, focus effort, define or clarify the organization, and provide consistency or guidance in response to the environment. Porter [5] added more emphasis to competition and environment which company is acting by stating: *“The essence of formulating competitive strategy is relating a company to its environment.”* Porter also detailed it to: *“Broad formula for how a business is going to compete, what its goals should be, and what policies will be needed to carry out those goals”* [5]. From the definitions of strategy, we should not forget the Peter Drucker’s, widely known, first strategic question what top management should ask: *“What is our business?”*, and his advice that top management should *“Make sure it is carefully studied and correctly answered”* [6]. Combination of Drucker’s and Chandler’s work was made by Andrews [7] *“Strategy is the pattern of objectives, purposes or goals and major policies and plans for achieving these goals, stated in such way as to define what business the company is in or is to be in and the kind of company it is or is to be.”*

Despite all of these different definitions, there are no exact and unambiguous, commonly agreed definition for strategy. E.g., there has been quite harsh critique between strategy experts and scholars, as seen in Ansoff’s article discussing Mintzberg’s ideas [8]. This is quite typical situation in social sciences and the end “truth” may never be revealed. Only guarantee is that more clarified and detailed definitions will occur. Nevertheless what definition would be, strategy is something that organizations will formulate in never ending rivalry or reach to better performance and results. In this paper, definition to strategy is taken from Mintzberg and it is typically utilized in common terminology, as a “plan” [9].

3 Strategy Implementation

Peter Drucker has said that: *“Plans are only good intentions unless they immediately degenerate into hard work”* [10]. There is a saying at least in Finland, that: *“Well planned is half done.”* However, nowadays it is more often changed to form *“Well planned is not yet even started.”* This new formulation of old saying and Drucker’s

statement are well indicating the fact that plans are worthless without impact. As this paper is handling strategy implementation and responsibilities in implementation process, it doesn't consider how the strategy formulation process is done or which approaches are utilized in formulation. Strategic planning process typically involves different stages from analysis to strategy plan distribution. There are several different approaches for starting point of strategic planning from top-down to bottom up and from strategic resources to market driven approach. No matter which strategy formulation approach is utilized there seems to be huge difficulties especially in implementation of the strategy.

Hrebiniak [11] stated: *“Formulating strategy is difficult. Making strategy work – executing or implementing it throughout the organization – is even more difficult.”* Strategy implementation has received less interest in research than strategy formulation and strategic planning [12–15]. Suggested reasons for this are that strategic implementation is less glamorous than strategy formulation, belief that everyone can do it, it is not easy to limit where it starts and ends and there are only few conceptual models to do it [16]. Former strategy textbooks are also handling implementation as organizational structure and systems adjustment (cf. Galbraith [17], Hrebiniak and Joyce [18], Higgins [19], and Pearce and Robinson [20]) and hence it is not highlighted as much as implementation. This process, which contains only two elements formulation and implementation, is nowadays set under scrutiny and critiqued. E.g. Kotter [21] introduced his well-known model for “strategic fitness” and emphasizes continuous work between formulation and implementation. This question towards the nature of strategy is also heightened before. Chaffee [22] recognized three different natures of strategy: First one is linear strategy, which is linear process of formulation and implementation and focus is in organizations plans and its goals. Second is adaptive strategy which is also linear by nature of implementation, i.e. formulation first and implementation second, but it recognizes that planning phase is more iterative and it adapts to environment more and is more prone to resources and environment of the organization than goals of organizations. Third is distinctive by its means to influence to the minds of stakeholders and for reasoning the legitimacy and creditability of organization. Third one is called to interpretive strategy.

Mintzberg [9] also recognized the problem of two-phase strategy process. He differentiated intended, unrealized, deliberate, emergent and realized strategy from each other's. No matter which approach or how many phases or iteration rounds there may be in chosen strategy process there still always be implementation, either in the end of the process or many times in process. In any chosen way, we have to remember the Drucker's statement that plans (strategies) need impact. After all, strategies are meant find out that organization's *“distinctive competence”* by Philip Selznick [23], find the *“Blue ocean”* [24], *“Competitive advantage”* [5], *“shared value”* [25] or any other desired things or situations, it have to be put into work i.e. be implemented. If it is not implemented, nothing will change. Therefore, we cannot disregard the problems in implementation process. We might say that good strategy is to guarantee that *“we make the right things”*, and good implementation process ensures that *“we make the things right”*.

3.1 Strategy Implementation Obstacles

Most of the larger changes in strategies seems to fail from the perspective of intended impact versus actual results. Kotter [26] based his change management, or change leading, model to this recognition. Jansen [27] recognized that despite that 80% of leaders felt that their company is good at strategy formulation only 44% are good at its implementation. Results of the same study shows that only 2% felt that they will achieve their strategic objectives. At least two-thirds of objectives were achieved only in 10% of organizations and 54% of companies achieved less than half of the objectives. One survey pointed that 57% of companies were unsuccessful at executing strategic initiatives over the past three years, when asking their senior operating executives [28]. Strategy implementation efforts fails with estimates between 30 and 70% [29, 30]. *“Classically somewhere in the range of half of all ideas described in strategic plans never see the light of day”* [31]. Similar researches and studies, with different perspectives, are done formerly, but the results remain same. Therefore, it is crucial to figure how these obstacles for strategy implementation could be avoided. This paper scrutinizes the failures from implementation point of view and gathers the obstacles and possible actions to conceptual model.

Research for the obstacles in strategy implementation is done, but not in large amounts. Aaltonen and Ikävalko [32] found that lack of two-way communication, top-down and bottom up, is an obstacle. Two-way communication is needed to ensure peoples' understanding about desired strategy and changes it brings to organization. They also highlighted the role of middle managers and their communication skills in their results. Study [32] addressed importance structured implementation process, system to derive work related objectives from strategy and system for compensation to key issues, and therefore lack of them are considered to be obstacles. Allio [33] composed list of obstacles and emphasized six main issues as following: Peoples' need to get back to real job, inability to translate ideas to actions, no reward in sticking in implementation/strategy, losing the track/inability to monitor actions, lack of responsibility i.e. everybody is responsible/nobody is responsible and plans lose their relevancy. Hrebiniak [11] concluded that top 5 obstacles in strategy execution are: (1) inability to manage change effectively and overcome resistance to change, (2) poor or vague strategy, not having guidelines or a model to guide strategy implementation efforts, (3) poor or inadequate information sharing among individuals/units responsible for strategy execution, (4) trying to execute a strategy that conflicts with the existing power structure and (5) unclear responsibility or accountability for implementation decisions or actions. Cândido and Santos [34] did perhaps one of the most thorough reviews that have been done in last years. They reviewed research papers from EBSCO Host Research Database and gathered dataset of 65 identified obstacles from former researches. In their research, they grouped these obstacles to 14 different domains as following: leadership, time available, communication and perceptions, reluctance to change/fear of loss, behavioral diagnosis, people's skills/training, participation/involvement, culture and climate, structure, change extension/projects/short-term wins, coordination, resources, performance management and external events. Cândido and Santos [34] also introduced that obstacles are connected to each other's. As a conclusion, it might be said that there is feasible amount of

scientific knowledge that we could draw a picture that large number of obstacles are identified in strategy implementation.

3.2 Change Management and Strategy Implementation Process

Change management has been one of the “hot” research topics in past decades. Reason for this is easy to understand, fast changing world. There is no status quo in the world even that there can be status quos found in organizations and peoples’ minds. Pettigrew and Whipp [35] argued that there is no universal rules to be utilized in change management and leadership. Despite their argument several different approaches and concepts has been introduced during the years for organizations to follow. Kotter [21, 26], Beer and Nohria [35], Garvin and Roberto [37], Levy and Merry [38], Kanter et al. [39] and Luecke [40] to name a few. Todnem [41] made good comparing for Kanter et al.s’ [39], Kotter’s [21, 26] and Luecke’s [40] models and it shows quite clearly that that from upper level point of view models are rather similar but they complement each other’s. All of these approaches provide well-argued upper level guidelines for organizations to follow in organizational change. Problem lies in level of interest and details regarding implementation. Even that approaches discussed above provide quite practical directions in overall change process they still are handling implementation in rather abstract level.

Kaplan and Norton [42] provided their approach for “*closed-loop management system*” links between strategy and operations. They have five stages in their model. Strategy development, strategy translation, plan for operations, monitoring and learning, and testing and adapting the strategy are the key stages. From operational point of view, strategy translation, plan for operations and monitoring and learning are pinpointing the practical levels of strategy implementation. Authors [42] suggested that in strategy translation first managers should translate strategy into strategic objectives and measures that are clearly communicated to employees by combining these between three to five strategic themes. Second, managers should observe how these themes deliver benefits in different time periods for simultaneous value creation for short-, intermediate-, and long-term processes. Third step is to integrate initiatives to portfolios and dedication and authorization of resources for them. Norton and Kaplan [42] suggest that every objective should not have independent initiative, but integrated one, which should close the performance gaps. Responsibility for strategic themes should be given to person(s) who have power enough to lead cross-functional objectives in portfolio. In plan for operations, first thing to do is prioritizing the process improvement projects with suitable process management and development approaches. After prioritization of processes they should be deconstructed in order to find out critical success factors and metrics, such way, that employees could focus to them in their daily work. Dashboards for visible information should be utilized. Different plans, for e.g. sales plan, are then translated to resource capacity plan. This resource plan is then calculated to financial “*dynamic operating and capital budgets*”. For monitoring the implementation, authors [42] suggest that three kinds of review meeting should be assembled: operational review (weekly or with shorter intervals), strategy review (monthly) and strategy testing and adapting (annually or quarterly).

4 Influence, Power, Personal Traits and Responsibilities

Manager’s, and all employees, possibility to influence to organization is dependent on two different dimensions. One dimension is the organizational position, i.e. how high a position does the person possess and how much management system gives freedom for that position. The other dimension is the level of leadership, or charismatic level, introduced by Maxwell [43]. Figure 1 illustrates an influence matrix that presents these two dimensions. The organizational position is quite a clear concept. Therefore, it is enough to say, in most cases, that the higher position you have, the more power you have to make things happen. Position names in Fig. 1 are for demonstration purposes only. The power of the influence grows when moving to the right on the x-axis. The y-axis consists of reasons why people follow the leader. Y-axis levels also represent the efficiency of the leadership and how eagerly people follow the leader. People’s eagerness to follow and the efficiency of leadership grow when moving up the y-axis. In general, irrespective of which rights are given to which leader, in specific companies, it can be observed that a department manager on leadership level four (blue shaded area) has more influence on the organization than the CEO who is on the first leadership level (red shaded area).

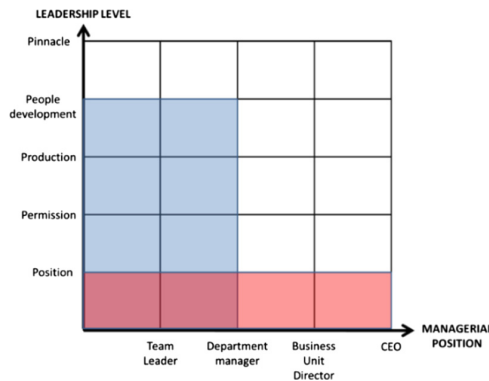


Fig. 1. Influence matrix

Managers, and all organization members, are in different situations and different positions. Activities in strategy implementation are therefore different. Thus, their responsibilities should reflect their possibility to influence. It is very useful to understand that possibilities to influence to organization is not only dependent from hierarchical position, but also charismatic leadership when issuing the responsibilities in strategy implementation process. These issues are also expressed as for the need of leadership and management capabilities and skills are highlighted in many former researches and approaches e.g. Kotter [21, 26], Luecke [40], Nadler and Tushman [44], Kanter et al. [39], for winning the “hearts and minds”.

Issue of power is raised in different researches and approaches. Radomska [45] concluded that “*Competent delegation of decision-making power to leaders from*

different levels of the organizational structure” and *“Clear segregation of powers by appointing a person or a special team, whose task will be to monitor and coordinate the strategy implementation process.”* are most important in strategy implementation. Norton and Kaplan’s [42] notation for strategic theme leaders as senior executive and Kotter’s [26] guiding coalition means person(s) with enough power and accountability, Tichy and Ulrich [46], Cameron et al. [47], Johnson [48–50], Nader and Tushman [44], Harris and Ogbonna [51], Sirkin et al. [52], Stadler and Hinterhuber [53], Hrebiniak [11] delivered the question of power, or lack of it, as key role in strategy implementation. Hence, it is quite clear that people involving in strategy implementation should have enough organizational power to execute needed operations and actions.

Personal traits are highly affecting people’s actions and performance. Berglas [54] divides the personal traits of time abusers into four main categories: perfectionist, preemptive, people pleaser and procrastinator. Perfectionists are people who are afraid of letting even completed work go. They are trying to reach unrealistic objectives and excellence in their work. These self-made requirements of perfection delay the progress of work or even keep others hostage to the perfectionist’s schedule. Preemptives are people who have an obsession about the early completion of tasks and assignments. They are trying to achieve a feeling of control by getting everything ready as fast as possible. People pleasers are persons who cannot say no. They will take more and more responsibility for different issues. The result will be that they are not able to accomplish their work and start delaying everything they are involved in. Procrastinators are people who postpone task initiation and, in the worst case, even undermine their own work. In order to delay, procrastinators might use the sentence: “I’ll do that as soon as I get monkey off my back.” By undermining their own work, they might find several reasons why the achievement or result of the work is not better, when the reasons are actually self-made or at least largely exaggerated [54]. To this Berglas’ list personal trait named to “optimistic planning personality” should also be added. People seemed to be characteristically optimistic towards schedule predictions and this optimism will be multiplied if there is new technology involved. People tend to concentrate on their own planning forward rather than utilizing already known information and “outsiders” experiences from past of incorrect predictions and schedules. Optimism in plans is higher if there are political or commercial pressures or there are financial incentives promised for the quick accomplishment of the task. If a person also has the tendency for procrastination, an optimistic prediction is even more likely. Strong goal-orientation might also have its costs in the preciseness of judgment capability. Affinity to details is also found to affect, so that scheduling is made in too optimistic a way. The more details and accuracy in the plan will make more error in the schedule [55].

When combining all these needs and point-of-views it could be concluded that the person(s), who will be appointed to, no matter which, position(s) in strategy implementation are in huge responsibility and the odds are against the person. Actually, when thinking the nature of strategy implementation, it also could thought, that isn’t people who is not involved in strategy implementation. Alternatively, if there is, strategy implementation is not succeeded.

5 Results and Discussion

Combination from obstacles in different implementation phases are integrated to actions and responsibility levels in Table 1. Responsibility is given with different combinations. TM means top management, MM middle management and FL frontline i.e. executive workers. Combinations are also used. Combinations means that these levels should contribute into those certain actions in that phase. These results are not meant to be recipe for success but more guideline and concept for tackling the obstacles in implementation process. Purpose is to create awareness towards formerly identified obstacles, at which phase they should be reacted, and what may be the concrete actions for handling the problems. Actions are combined from articles cited in this paper and enhanced by lean and other methods.

Table 1. Integration of strategy implementation level, obstacles, responsibility and actions

Phase	Obstacle	Responsibility	Actions
Strategic objectives and measures to tactical level	Poor choice of introducing change	TM	Create a vision and a common direction. Create sense of urgency
	No participation or middle-management commitment	TM	Empower Middle management. Find shared value
	Choosing edicts or plan without receptivity	TM-MM-FL	Assessment of shared value or at least lowest common denominator. Clarify measures and how they can be influenced
Communication	Selective attention towards information (prone to isms)	TM-MM	Be brutally honest. Question the beliefs. Utilize triple loop learning or similar method
	No anticipation to potential problems	TM-MM	Question the optimism. Identify optimistic planning personalities. Create “what if?” and worst-case scenarios
	No sincere dialogue about conflicting aspects and obstacles	TM-MM-FL	Be brutally honest. Map these openly
	No sharing of interpretation of plans	TM-MM-FL	Clarify terms and means. Speak the language that everybody understands
	No knowledge of internal opinion	TM-MM-FL	Make organizational analyze of opinions. Identify the opinion leaders
	No two way communication	TM-MM-FL	Provide real possibility to discuss. Utilize Catchball method or similar

(continued)

Table 1. (continued)

Phase	Obstacle	Responsibility	Actions
Combination to themes	Fear that change will upset current balance of power between groups or units	TM	Clarify shared value. Create incentives system. Ensure workplaces as much as possible
	Themes against existing power structure	TM	Authorize positions and persons. Build prestigious steering group. Identify opinion leaders
	Tradition bound, paradigm persistence	TM-MM	Separate from the past. Create sense of urgency
Dividing value creation for different time periods	Strategic drift	TM	Stick to the plan. Sometimes you're ahead and sometimes behind. Review strategy systemically but between reviews be persistent
	Extension of change, number of people and units	TM	Stick in the reasonable plan even when everything looks very bright. (Don't be pre-emptive)
	Internal problems that were not anticipated (e.g. over optimistic expectations towards stability in personnel etc.)	TM-MM	Identify personal traits and avoid their affect. Don't try to deliver 100% performance in change
	Short time available for change, excessive speed of changes	TM-MM	Identify personal traits and avoid their affect. Be aware of organization's true performance level
Initiatives to portfolios	No participation or middle-management commitment	TM	Commit the middle management with empowering and shared value. Utilize Catchball method or similar
	Tradition bound, paradigm persistence	TM	Separate from the past Create sense of urgency
	Fear that change will upset current balance of power between groups or units	TM-MM	Assessment of shared value or at least lowest common denominator. Clarify measures and how actions are connected to measures

(continued)

Table 1. (continued)

Phase	Obstacle	Responsibility	Actions
Resources and authorization	Structural changes that were not required or in excess	TM	Analyze true need of structure change. Resist urge for “change because of chance”
	Lack of strong power coalition pro-change	TM	Authorize positions and persons. Build prestigious steering group. Identify opinion leaders
	Limited available resources	TM-MM	Be sure of organization’s true performance level. Identify personal traits and avoid their affect
	Resources committed to past decision	TM-MM	Analyze processes and work. Gave up or finish obsolete work before you add new ones
	Withdrawal of resources	TM-MM	Stick to the plan. Sometimes you’re ahead and sometimes behind. Review need of resources systemically but between reviews be persistent
	No empowerment	TM-MM	Clarify shared value. Utilize Catchball method or similar. “Free” people to do new
Prioritizing	Conflicting organizational priorities	TM	Build prestigious steering group. Find lowest common denominator. Prioritize clearly
	Extension of change, number of people and units	TM-MM	Stick in the reasonable plan even when everything looks very bright. (Don’t be pre-emptive)
	Too many initiatives under work at same time	TM-MM	Prioritize and check suitable amount. Utilize e.g. Catchball method
Process management	Hijacked processes	TM-MM	Based on the strategic objectives, define objectives for key processes
	Control/rewards system reinforce paradigm and status quo	TM-MM	Decompose tactical objectives and key objectives into operating targets established for the executive personnel. Introduce a system of incentives for the corporate strategy implementation

(continued)

Table 1. (continued)

Phase	Obstacle	Responsibility	Actions
	Inadequate feedback and learning	TM-MM	Measure all objectives. Utilize e.g. triple learning loop
Deconstruction	Strategy efforts against existing power structure	TM	Authorize positions and persons. Build prestigious steering group. Identify opinion leaders
	Habits, low tolerance for change, reluctant to let go	TM-MM-FL	Decompose tactical objectives and key objectives into operating targets established for the executive personnel
Critical success factors and metrics	No incentives for strategy implementation	TM-MM	Measure all objectives. Utilize e.g. triple learning loop. Introduce a system of incentives for the corporate strategy implementation
Employees everyday work	Personnel attention distracted from implementation, day-to-day activities take all the time, delays	TM-MM-FL	Decompose tactical objectives and key objectives into operating targets established for the executive personnel. Realize that change can't be done with "left hand"
Visualization		TM-MM	Visualize metrics and achievements. Utilize dashboards and charts for key indicators of local process performance. Utilize colors and comparative visualizations
Plans to capacity and resource plan		TM-MM-FL	Utilize e.g. Lean Cathcball method
Resource plan to budgets		TM-MM	Utilize e.g. Lean Cathcball method

As seen from the Table 1 it is in early phase of larger research for change management and strategy implementation. It still points out some clear things to focus in order to avoid troubles in strategy implementation. One of the key points are that strategy implementation is holistic matter and it should penetrate all levels in organization. Middle managements role seems to be crucial. When scrutinizing the Table 1, leadership and management methods for firm and clear task decomposing and

composing could be the key for better implementation. These methods will also enhance the information flow between different organizational levels. The list is not thorough and it is still ill structured. Following research should be done in order to enhance the model. More wider integration for obstacles should be found. By adding more obstacles found in former research picture becomes richer and provides more solid ground for concept. Relations and interrelations between obstacles and actions should be researched. May there be some key actions which could lessen the number and magnitude of obstacles more easily than other actions? How these actions could be integrated to strategy planning and implementation processes so that obstacles are terminated?

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References

1. Von Clausewitz, C.: *On War*. Princeton University Press, Princeton (1989)
2. Liddell Hart, B.H.: *Strategy*, 2nd rev edn. Faber, London (1967)
3. Chandler, A.D.: *Strategy and Structure*. MIT Press, Cambridge (1962)
4. Mintzberg, H.: Why organizations need strategy. *Calif. Manag. Rev.* **30**, 25–32 (1987)
5. Porter, M.: *Competitive Strategy*. Free Press, New York (1980)
6. Drucker, P.: *The Practice of Management*. Harper & Row, New York (1954)
7. Andrews, K.: *The Concept of Corporate Strategy*, 2nd edn. Dow-Jones Irwin, Homewood (1980)
8. Ansoff, I.: Critique of Henry Mintzberg’s “The design school: reconsidering the basic premises of strategic management”. *Strateg. Manag. J.* **12**(1), 449–461 (1991)
9. Mintzberg, H.: Patterns in strategy formation. *Manag. Sci.* **24**(9), 934–948 (1978)
10. Drucker, M. <https://www.goodreads.com/quotes/65135-plans-are-only-good-intentions-unless-they-immediately-degenerate-into>
11. Hrebiniak, L.: Obstacles to effective strategy implementation. *Org. Dyn.* **35**(1), 12–31 (2006)
12. Greer, C., Lusch, R., Hitt, M.: A service perspective for human capital resources: a critical base for strategy implementation. *Acad. Manag. Perspect.* **31**(2), 137–158 (2017)
13. Martin, J.A., Eisenhardt, K.M.: Rewiring: cross-business unit collaborations in multibusiness organizations. *Acad. Manag. J.* **53**(2), 265–301 (2010)
14. Priem, R.L., Walters, B.A., Li, S.: Decisions, decisions! How judgment policy studies can integrate macro and micro domains in management research. *J. Manag.* **37**(2), 553–580 (2011)
15. Raes, A.M.L., Heijltjes, M.G., Glunk, U., Roe, R.A.: The interface of the top management team and middle managers: a process model. *Acad. Manag. Rev.* **36**(1), 102–126 (2011)
16. Alexander, L.D.: Strategy implementation: nature of the problem. *Int. Rev. Strateg. Manag.* **2**(1), 73–91 (1991)
17. Galbraith, J.R.: *Strategy Implementation: The Role of Structure and Process*. West Publishing Co, St Paul (1980)
18. Hrebiniak, L.G., Joyce, W.F.: *Implementing Strategy*. Macmillan, New York (1984)

19. Higgins, J.M.: *Strategy: Formulation, Implementation and Control*. Dryden Press, Chicago (1985)
20. Pearce, J.A., Robinsons, R.B.: *Strategic Management: Formulation, Implementation, and Control*. Irwin, Bur Ridge (1994)
21. Kotter, J.P.: *Accelerate: Building Strategic Agility for a Faster-Moving World*. Harvard Business Review Press, Boston (2014)
22. Chaffee, E.: Three models of strategy. *Acad. Manag. Rev.* **10**(1), 89–98 (1985)
23. Ghemawat, P.: Competition and business strategy in historical perspective. *Bus. Hist. Rev.* **76**(1), 37–74 (2002)
24. Kim, W.C., Mauborgne, R.: *Blue Ocean Strategy*. Harvard Business Review Press, Boston (2016)
25. Porter, M.: Creating shared value. *Harvard Bus. Rev.* **89**(1/2), 62–67 (2011)
26. Kotter, J.P.: *Leading Change*. Harvard Business School Press, Boston (1996)
27. Jansen, H.: 94 Mind-Blowing Strategy Execution Stats. Boardview. <https://boardview.io/blog/strategy-execution-stats/#execution>. Accessed 12 Jan 2019
28. Economist Intelligence Unit: *Strategy execution: achieving operational excellence, a survey of 276 senior operations executives from North America (2004)*. http://graphics.eiu.com/files/ad_pdfs/celeran_eiu_wp.pdf
29. Cândido, C.J.F., Santos, S.P.: Is TQM more difficult to implement than other transformational strategies? *Total Qual. Manag. Bus. Excellence* **22**(11), 1139–1164 (2011)
30. Cândido, C.J.F., Santos, S.P.: Strategy implementation: what is the failure rate? *J. Manag. Organ.* **21**(2), 237–262 (2015)
31. Burlton, R.: *Delivery business strategy through process management*. In: vom Brocke, J., Rosemann, M. (eds.) *Handbook on Business Process Management 2, Strategic Alignment Governance, People and Culture*. Springer, Heidelberg (2015)
32. Aaltonen, P., Ikävalko, H.: Implementing strategies successfully. *Integr. Manuf. Syst.* **13**(6), 415–418 (2002)
33. Allio, M.K.: A short, practical guide to implementing strategy. *J. Bus. Strategy* **26**(4), 12–21 (2005)
34. Cândido, C.J.F., Santos, S.P.: Implementation obstacles and strategy implementation failure. *Baltic J. Manag.* **14**(1), 39–57 (2018)
35. Pettigrew, A.M., Whipp, R.: *Managing Change for Competitive Success*. Blackwell, Cambridge (1993)
36. Beer, M., Nohria, N.: *Cracking the code of change*. *Harvard Bus. Rev.* **78**(3), 133–141 (2000)
37. Garvin, D.A., Roberto, M.A.: Change through persuasion. *Harvard Bus. Rev.* **83**(2), 104–112 (2005)
38. Levy, A., Merry, U.: *Organizational Transformation*. Praeger Publishers Inc., New York (1986)
39. Kanter, R.M., Stein, B.A., Jick, T.D.: *The Challenge of Organizational Change*. The Free Press, New York (1992)
40. Luecke, R.: *Managing Change and Transition*. Harvard Business School Press, Boston (2003)
41. Todnem, R.: Organisational change management: a critical review. *J. Change Manag.* **5**(4), 369–380 (2005)
42. Kaplan, R.S., Norton, D.P.: Mastering the management system. *J. Change Manag.* **5**(4), 369–380 (2008)
43. Maxwell, J.C.: *5 Levels of Leadership: Proven Steps to Maximize Your Potential*. Center Street, New York (2011)

44. Nadler, D.A., Tushman, M.L.: Beyond the charismatic leader: leadership and organizational change. *Calif. Manag. Rev.* **32**(2), 77–97 (1990)
45. Radomska, J.: The role of managers in effective strategy implementation. *Int. J. Contemp. Manag.* **13**(3), 77–85 (2014)
46. Tichy, N.M., Ulrich, D.O.: The leadership challenge – a call for the transformational leader. *Sloan Manag. Rev.* **26**(1), 59–68 (1984)
47. Cameron, K.S., Whetten, D.A., Kim, M.U.: Organizational dysfunctions of decline. *Acad. Manag. J.* **30**(1), 126–138 (1987)
48. Johnson, G.: Rethinking incrementalism. *Strateg. Manag. J.* **9**(1), 75–91 (1988)
49. Johnson, G.: Managing strategic change: the role of symbolic action. *Br. J. Manag.* **1**(4), 183–200 (1990)
50. Johnson, G.: Managing strategic change: strategy, culture and action. *Long Range Plan.* **25**(1), 28–36 (1992)
51. Harris, L.C., Ogbonna, E.: The unintended consequences of culture interventions: a study of unexpected outcomes. *Br. J. Manag.* **13**(1), 31–49 (2002)
52. Sirkin, H.L., Keenan, P., Jackson, A.: The hard side of change management. *Harvard Bus. Rev.* **83**(10), 109–118 (2005)
53. Stadler, C., Hinterhuber, H.H.: Shell, Siemens and DaimlerChrysler: leading change in companies with strong values. *Long Range Plan.* **38**(5), 467–484 (2005)
54. Berglas, S.: Chronic time abuse. *Harvard Bus. Rev.* **82**(6), 90–97 (2004)
55. 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)



ENGINE Model – Changing Higher Education with Industry Cooperation

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Abstract. The rapidly growing maritime industry of Southwestern Finland is suffering from lack of engineers. Industrial Management Engineers including Sales Engineers have technical knowledge and commercial competencies as well as management and soft skills, which are all fundamental for the maritime sector. However, it takes rather long time before a graduated engineer will be a productive worker for the company. A solution to getting the students faster operational into the companies is to deepen cooperation between higher education and industry during the studies and increase workplace based learning following the examples available in e.g. Germany and France. The authors present a new approach of academic-industrial cooperation in education in Finland which is developed in the frame of the project ‘RADICAL - Filling Skills Gaps in Blue Industry by Radical Competence Boost in Engineering VET (VET: Vocational Education and Training)’, co-funded by the Erasmus+ program of the European Union.

Keywords: Higher education · University-Industry cooperation · AASE · Dual degree study program · Sales engineering · Blue industry

1 Introduction

The European (EU-28) maritime technology industry is the leading global region in terms of aggregated production value, with a calculated value of 112.5 billion Euros [1]. The European maritime technology industry employs over 500,000 people [2]. The European maritime technology industry is crucial for the economy and employment in Finland where around 30,000 people were employed and 8 billion euros’ annual turnover was generated in 2014 [3], which is about 3.5% of Finland’s GDP [4]. The main challenges are that increased success in business and the complexity of the products have created additional demand for highly skilled staff. Therefore, a large part

of the industry is suffering from a scarcity of skilled personnel and this is a restriction to growth. Industrial Management Engineers including Sales Engineers have technical knowledge and commercial competencies as well as management and soft skills [5], which are all fundamental for maritime sector. The challenge is to increase the speed of getting students operational to companies to support the needs of the maritime cluster.

After a brief description of the RADICAL project objectives, the article describes the steps of developing the ENGINE and the mentoring model, which are critical to ensure the success of the ENGINE model to be launched in 2019 at Turku University of Applied Sciences (TUAS).

2 RADICAL Project Objectives

In 2017, four members of the Academic Association of Sales Engineering (AASE), together with industrial and institutional partners, submitted the proposal ‘RADICAL - Filling Skills Gaps in Blue Industry by Radical Competence Boost in Engineering VET’ project under the coordination of Turku University of Applied Sciences (TUAS) which is currently funded by the Erasmus+ program of the European Union. The article presents a new educational approach in Finland – the possibility of making a bachelor’s degree through workplace based learning – so that almost half of the studies will be performed in industry.

The RADICAL project can be seen as a fundamental reformation of the industry-Higher Education Institution (HEI)-student cooperation in Finland. The project offers a new model for students and professionals in the career path towards new and better jobs, especially in the Blue Sector of Southwestern Finland. The core of the ENGINE (Engineering Innopeda Education) model developed in the RADICAL project is a new regional implementation model for post-secondary engineering education supported by a business mentoring model. The objective is to provide high quality combination of higher education and work-based learning, leading students to have both a full bachelor’s degree and in-depth practical experience at the workplace.

3 Towards Higher Education–Industry Education Cooperation in Finland

There has been a lot of interest, studies and projects towards Higher Education (HE)-industry cooperation in Finland already before the RADICAL project.

In a study carried out by the University of Helsinki in 2009, 58 companies and organizations from southeastern Finland were interviewed to find out their readiness to higher education cooperation through workplace learning in a similar way as the existing apprenticeship in vocational education. There were several positive findings from the research, e.g. that students would learn sooner how to operate in actual working life and that cooperation between companies and educational institutes would be more proactive. Companies requested a clear framework or model for the workplace learning [6].

Haaga Helia University of Applied Sciences has also carried out a project to develop a HE apprenticeship model mainly for the continuing studies in southern

Finland in 2007–2009. In this model, the learning was based on development projects carried out at the company. Important elements are combining theory and practice, and the request for a mentor at the workplace to support the learning process. Even though the main point of view is the lifelong learning of the student, the report also emphasizes the benefits to the company, which will receive e.g. new knowledge and can utilize that in its development. This model also introduces a learning network, where the educational institution will facilitate a learning forum among the participating companies and students. This will enable sharing knowledge among companies, from mentor to mentor, student to student, and between HEI and companies [7].

TUAS participated in 2015–2017, together with 13 other UAS in Finland, in a project called “Verkkovirta”, financed by the European Union via the European Social Fund. The objective of the project was to create new forms of studification, a model to learn in collaboration between higher education and workplace. Studification means ways for earning study credits from student’s daily work. Studification of work is described to be a relatively new, alternative way of studying at UAS where learning is brought from the UAS to the workplace. Competences gained by working are connected with the knowledge basis of each substance. The project material explains that work studification will have a positive impact on the student’s professional development, study progress and graduation [8]. The studification has been started gradually also at TUAS. TUAS mentions it in its degree-regulations “Recognition of Competence”, a concept enabling the possibility to include workplace learning as part of the degree. The competence to be recognized must meet the competence objectives of the study modules or courses. The student must demonstrate the competence gained at the workplace. The student can be assigned complementary or reflective tasks related to the accreditation. The student can perform the demonstration in several ways and it will be graded with the same scale as other students.

All three examples above show that there is a very positive and clear direction for creating the ENGINE model to Southwestern Finland. To further emphasize the need for such a model, the Federation of Finnish Entrepreneurs has recently made a proposal to bring the apprenticeship model to bachelor level post-secondary education [9].

4 Higher-Education-Industry Cooperation Outside of Finland

Germany has a long-term history of the so-called dual, related to different learning locations, education system. It combines practical training in a company and vocational training in a vocational school. At the beginning of the 1970s, this system was transferred to the academic system and has considerably grown during the last decade. While only 41 dual study courses were listed in 1996 [9], at the end of 2016 German HEI offered 1,592 dual study programs with more than 100,000 students and 47,000 cooperating companies [10].

This large number of courses is characterized by a great diversity. However, for first-degree programs, this diversity can be attributed to different study models, Table 1, which can be distinguished mainly by two criteria [10–12]: The type of the practical phases and the organization and interlinkage of academic and practical

training phases. For the first and third model, practical training phases during non-lecture periods complete the model. A similar distinction is possible for postgraduate study programs. Often, combinations of different models during different study phases are integrated in the pedagogic programs.

Table 1. Organization and interlinkage of academic and practical phases of dual first-degree programs in Germany (according to [10–12])

Type of practical phases	Weekly interlinkage	Block model	Internship/apprenticeship semesters
Apprenticeship-/job-integration	UAS Hannover	e.g. BachelorPlus DHWB Heidenheim	e.g. “hochschule dual” in Bavaria
Practice-integration	Usually practical phases without reference to curriculum ^a	e.g. UAS Bielefeld	e.g. Hamburg UAS

^aIn contrast to [10], study programs with parallel practical training periods or part-time jobs phases without reference to the curriculum (so-called practice- or job-accompanying study courses) are not counted as dual study course here.

The strong growth of the dual study programs in recent years has been largely driven by the practice-integrated study models, which have raised from 395 in 2011 to 805 in 2016. In the same period, the amount of apprenticeship-integrated models has only increased from 447 to 565 and has even been decreasing since 2014 (592). Also, mixed study programs have become more familiar (37 (2011) to 222 (2016)) [11]. Thus, the practice-orientated study models and mixed models gain more and more importance in Germany. Nevertheless, not taking into account universities of cooperative education (including Baden-Wuerttemberg Cooperative State University), which are classically practice-orientated, the amount of apprenticeship-integrated programs (537) is still significantly higher than practice-orientated models (442) and mixed models (217) [12].

With regard to the time models, the authors observe that at HEI, which offer similar regular (non-cooperative) study courses, the majority of the time models are models with internship/apprenticeship semesters. The same holds for apprenticeship-integrated study courses. On the other hand, the block model predominates at private HEI, like UAS of Bavarian Economy, and purely cooperative HEI, like Baden-Wuerttemberg Cooperative State University.

The German and French project partners supporting the development of the ENGINE model, UAS Aschaffenburg, ESTA School of Business & Technology Belfort and UAS Hannover, bring a lot of experience with different models of cooperative studies to the project. UAS Aschaffenburg offers apprenticeship-integrated as well as practice-integrated dual study courses that include an internship semester and practical phases during non-lecture periods (third model). ESTA Belfort has some kind of block model, in which study phases alternate with practical phases of similar equal length (second model) (see [13] for details of both study programs). The model of the UAS Hannover combines weekly interlinkage (first model) until the end of the apprenticeship (first four semesters) with the third time model during the last three semesters.

The weekly interlinkage consists of three days vocational training at the company and three days per week at HEI and vocational school. This results in six days of practical and academic education per week. Thus, the model is on the one hand very demanding for the students, but on the other hand also very time-efficient. As a unique selling point, students achieve an apprenticeship qualification and a 210 ECTS Bachelor of Engineering degree in only seven semesters, the detailed study program is described in [12].

5 Preparatory Research in Southwestern Finland

The new ENGINE model only aims at revolutionizing the industrial implication in the study program, but not the content that is identical to TUAS' existing 'Bachelor of Engineering in Industrial Engineering and Management'. For this reason, the ENGINE model's pedagogic program is not subject of discussion here. Several questions have been analyzed to get an overview about potential options for the new model, e.g.: Who chooses the student and the company? Which scheduling between HEI and company time? Which agreements are needed?

The starting point of the ENGINE model development were a benchmark of the academic-industrial cooperation models used at the project partners' HEI and in Finland as described in detail in the previous chapter as well as in a recent article by Schneider-Störmann et al. [13].

The next phase in the ENGINE model creation was interviewing selected regional companies as potential partners of the learning model pilot and offer. After the company interviews, other stakeholders were also met and inputs collected. These included e.g. the student counseling, UAS legal advisor and other staff members, RADICAL project institutional members and the head of the regional apprentice office in Turku.

The research conducted during the 2nd quarter of 2018 by interviewing in total 14 companies within Southwest Finland (the 15th selected company did not want to participate) completed the benchmark. TUAS researchers conducted semi-structured interviews with company representatives. From the interviewed companies, five were micro and small sized companies employing up to 50 persons, three were medium sized companies employing between 51 and 200 employees, and six were large sized companies employing over 200 employees. From the interviewed companies, seven worked with manufacturing, five worked with designing and consulting and two with engineering and services. Except of one, all interviewed companies welcomed interns from different HEI in the past.

Choice of Companies and Students. The new model involves three parties, the company, the student and the HEI. Today, HEI select their students using an existing and generally well working application process. This application process does not consider companies' expectations or needs. In the future model, where companies shall participate in the students' training process, they must have a voice in selecting 'their' student. This can be optionally before, at the beginning or even after some months at the HEI. Depending on the choice, HEI can use the existing application and selection process or need to develop a completely new one involving company representatives. When the companies choose their candidate, the HEI must ensure that quality and access standards are respected. In all cases, the HEI must check that a student respects

all access requirements to get the right to study, but the final choice for a student must be in the responsibility of the company.

Choosing the right students for the right company can have a large impact on success of the ENGINE model. During the interviews, five different options for the selection process were presented, Fig. 1.

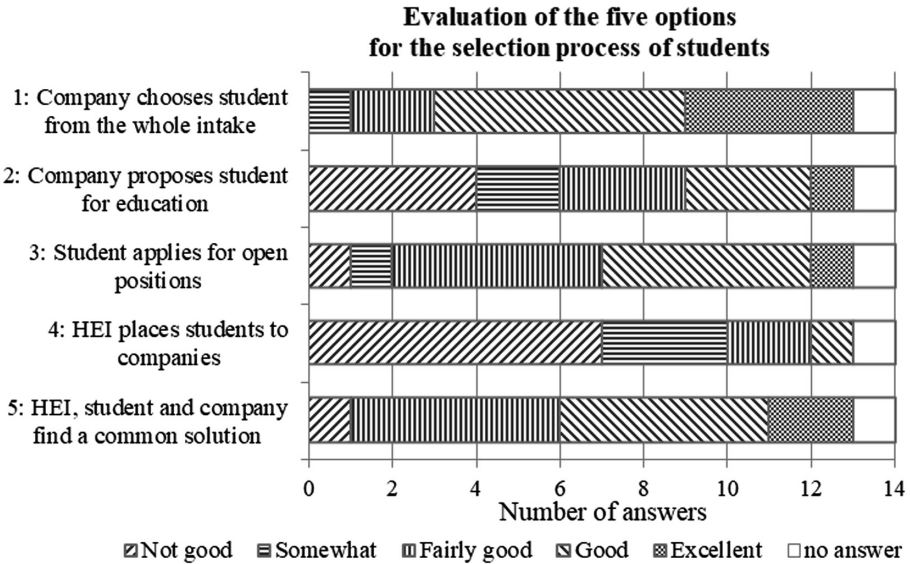


Fig. 1. Evaluation of the five options for the student’s selection process by the 14 interviewees (own graph).

As can be seen from Fig. 1, option 1 got the most ‘good’ and ‘excellent’ evaluations with 11 answers. Three other interviewees rated this option with ‘fairly good’. None of the interviewees found this option not to be good. The least favorable option was option 4, where HEI places students to companies. 11 interviewees rated it ‘not good’ or ‘somewhat good’, while only three evaluated it as ‘fairly good’ or ‘good’, and none of the interviewees rated it as ‘excellent’.

Scheduling the Studies. The benchmark of existing models in Germany and France showed different systems. At the Duale Hochschule Baden-Württemberg (Germany) students alternate between HEI and company every three month, in other cases students spend three days per week at the HEI and two at the company, do their company training during the periods without teaching or during several internships integrated into the academic program (see Sects. 4 and 6). Depending on the organization of the scheduling, a mix with traditional students is more or less easily feasible. If there is a need to split ENGINE and traditional students, additional costs are engaged due to doubled lectures and exercises.

The ENGINE model foresees studies combined with working phases following a predetermined rotation schedule. Finding the most suitable model for scheduling the

study and work periods can be the key to success of the model. The interviewers presented seven alternatives to the companies with the same evaluation grid as for the student's selection process, Table 2. Thirteen companies answered this question.

Table 2. Scheduling alternatives for the ENGINE model.

Number	Alternative
1	The student studies the first year at the HEI, and worktime of the following years is split between company and HEI
2	Students alternate each week with three days at the HEI and three days at the company, making six working day week
3	Students alternate each week with three days at the HEI and two days at the company, making five working day week
4	Students switch every week between HEI and company
5	Students switch every month between HEI and company
6	Students study three months at the HEI and three months in the company each semester
7	Students follow the HEI schedule, from August to December at HEI and from January to June in their company

The most suitable scheduling model was the one, where student first studies one year at the HEI with the worktime split between HEI and company for the following years. Ten interviewees evaluated this option with 'good' or 'excellent', while only two found it to be 'not good' or 'somewhat good'. Option 2 was rated worst. Ten interviewees found this rotation option to be 'not good' or 'somewhat good', Fig. 2.

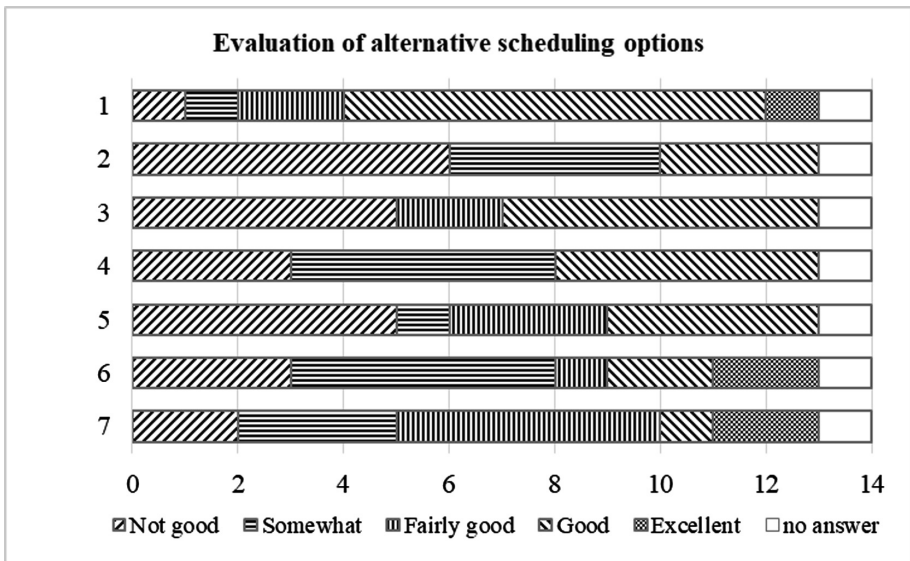


Fig. 2. Evaluation of alternative scheduling options (own graph)

One interviewee suggested an alternative model, where time-sharing between HEI and company changes with the advancement of studies. According to this model, students would spend 100% at the HEI in the 1st year, 75% in the 2nd year, 50% in the 3rd year and only 25% in their last year of studies.

Agreements. Companies must be involved in any case, as they shall hire the student. An employment contract is therefore the absolute minimum of legal binding. However, as the companies become responsible for teaching and respecting the rules of the ENGINE model, they must also sign a cooperation agreement with the HEI. The project partners consider that mixing up employment contract and cooperation agreement with the HEI in one document is too complex and should be avoided for the benefit of all three parties. Nevertheless, rules and a fallback solution are needed to ensure a student can finish his studies even if his agreement with the company fails at a moment.

The interviewers presented the following four options for evaluation: (1) the contract is between the student and the company, (2) the contract is between the university and the company, (3) the contract is between the student, the university and the company and (4) the contract is between the company and the HEI and student is having a working contract with HEI.

As a result, both options (3) and (4) got 7 positive evaluations ('good' or 'excellent'). The less interesting option seems to be (1) where the contract is only between the student and the company.

Other Results. When studied about the possibility for the company to assign an instructor for the student, eight interviewees responded this to have good or excellent changes. Eight companies estimated the needed time resource allocation for the student instruction as fairly good or good. Eight interviewees expressed the need of training related to guiding the student in the company. Eleven interviewees want to have meetings with the HEI on a regular basis: bi-monthly (five answers), twice a year (four answers), no specific suggestion for meeting interval (2 answers). In addition, eight interviewees said that the company will be able to provide required tools for the student, and another eight felt that they would have good or excellent possibilities to offer work life related assignments that support learning outcomes. Ten interviewees expressed that the company has good or excellent possibilities to offer thesis work for the student; eight interviewees were favorable for student's extended exchange period abroad, stating that this would fit their plans well or in excellent way. Ten companies thought that separate non-closure agreements need to be concluded. Seven companies announced that they would be willing to be part of the implementation of the ENGINE model and two declared that they would not be interested in participating. The other companies said that they would be interested in participating on a later stage or will consider it while attending.

6 The ENGINE Learning Model

Based on all the inputs, a proposal for the main phases and elements of the ENGINE model was created as explained below.

Application Process. Students will be admitted to TUAS' Industrial Management and Engineering degree program through the normal application process and fulfilling the admission criteria, at least in 2019. Currently, there is an emphasis in selecting students based on their report cards and results in matriculation exam in the upper secondary school, but the admission criteria for students coming from elsewhere than upper secondary school are being developed. This may bring potentially more students suitable for the ENGINE learning model. It is also possible for companies to send their employees to study a degree within the ENGINE model. In practice this means, that a student will start the first study year with the open TUAS study system, and after successfully passing first year's studies, the student can apply to become a degree program student through a separate application process.

During the first study semester, 20 students (from approximately 80) can compete to the ENGINE model through sending an application showing their motivation and suitability for this kind of learning.

Matching of the 20 students and participating companies will be done in the beginning of the first-year spring semester. The companies nominate a mentor.

Scheduling of Studies. ENGINE model students will study in the same pace as the normal group, and the module timetable of TUAS enables this model well. During the study semester, ENGINE students will stay 2–3 days at TUAS and 2–3 days at work (totally 5 days/week). The student will get the academic basis from TUAS, and they learn the practical part at the company almost simultaneously. During the two first years, students will spend a majority of time at TUAS due to mandatory basic studies. The student will carry out the annual practical training belonging to the degree program studies at his company. Normally the annual practical training takes 7 weeks. Student's duties and responsibilities will become more demanding with the advancement of the studies.

Agreements. Student and employer will sign a fixed-term employment contract. This is similar practice to current vocational education apprenticeship contracts. Each contract will be most probably done for one semester (+ summer period) or one year, i.e. six to twelve months. Students get a salary according to the agreement, most probably based on the experience of the student. The monthly salary will be formed according to working hours during the study period, e.g. two days corresponding to 16 hours per week. A cooperation agreement between HEI and the company defines roles and responsibilities of both sides.

Table 3 shows the structure of the ENGINE studies based on TUAS' 'Bachelor of Engineering in Industrial Engineering and Management' degree. It consists of 240 ECTS.¹ Within the ENGINE model, it is possible to acquire 115 ECTS at the workplace, including 30 ECTS for the three practical training periods (10 ECTS/study year, typically during the summer break). This represents thus almost half of the studies.

¹ European Credit Transfer System, 1 ECTS corresponds to about 25–30 h of student's work.

Table 3. Structure of the ENGINE studies

Study year	Autumn semester	Spring semester	Summer
1st year	Applying to ENGINE model	Matching, mentoring starts, 5 ECTS ENGINE studies	Practical training 10 ECTS
2nd year	15 ECTS ENGINE studies	15 ECTS ENGINE studies	Practical training 10 ECTS
3rd year	Exchange or IB 15 + 15 ECTS ENGINE studies	15 ECTS ENGINE studies	Practical training 10 ECTS
4th year	15 ECTS ENGINE studies	15 ECTS ENGINE studies (Bachelor's Thesis)	

Learning Agreement and Evaluation of Learning. After matching student and company, both parties will sign a learning agreement about the workplace studies. This learning agreement mentions the relevant study courses and modules. The learning objectives related to studies will be translated to a proposal for work content and responsibilities. Student and company will jointly set up a “work plan” for the next semester. The nominated mentor will follow the progress of the work plan with the student in regular mentoring meetings. The actual work instructor at the company may be someone else than the mentor.

TUAS will evaluate acquired learning results in close cooperation with a company representative at the end of each semester. Evaluation will be done against both learning objectives and knowledge of the process, methods, tools and theories. The student can demonstrate his knowledge with selected methods, depending on the course, e.g. by passing an exam, writing a report, doing an interview or making a presentation. TUAS representatives will always give the final grade marks.

Mentoring Model. The ENGINE model is supported with a mentoring model. Each company will nominate an experienced representative as mentor for the student. The mentoring model has two parts: the mentoring relationship including meetings between mentor and student, and the knowledge sharing workshops at TUAS. Before the learning period at the workplace will start, TUAS will provide training about mentoring and the ENGINE model to all mentors.

The mentoring relationship will have three phases: (1) start, (2) operation and (3) closing. In the starting phase, the mentor and mentee will get familiar with each other, agree on objectives for the mentoring, prepare a meeting plan and agree rules. After each mentoring meeting, the student will write a diary for himself about the discussions and results. In the closing phase, the partners agree about ending the mentoring relationship and make conclusions.

TUAS will also organize workshops, “peer meetings” with students and company mentors at least once per semester. The purpose of these workshops is to have

knowledge sharing, also tacit knowledge sharing, among all participants, building knowledge and networking. The ideology follows the SECI model introduced by Nonaka and Takeuchi [14].

7 Conclusions

The RADICAL project, co-funded by the European Union via the Erasmus+ program, aims at introducing a ‘radically’ new learning model in Finland using large academic-industry cooperation for learning.

The developed ENGINE model bases on long-standing existing experiences in Germany and France, on previous experimentations in Finland as well as on interviews with 14 selected potential partner companies. The ENGINE model’s academic program is identical with TUAS’ ‘Bachelor of Engineering in Industrial Engineering and Management’ degree program. Thus, this article discusses and defines organizational aspects of the new ENGINE study program, such as the choice of students and companies, the scheduling between HEI and companies, the necessary agreements and the application and registration of students.

The first class of ENGINE students will start in autumn 2019, and future research will show whether this new model will meet TUAS’ and companies’ expectations, or whether adaptations will become necessary.

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References

1. BALance Technology Consulting for European Commission: Study on new trends in globalisation in shipbuilding and marine supplies - consequences for European industrial and trade policy. EU publication (2017). <https://publications.europa.eu/en/publication-detail/-/publication/bc5fa041-bac0-11e7-a7f8-01aa75ed71a1/language-en>
2. European Commission: LeaderSHIP initiative 2020. The Sea, New Opportunities for the Future. Final report (2013). <http://ec.europa.eu/DocsRoom/documents/10504/attachments/1/translations>
3. Ministry of Economic Affairs and Employment of Finland: Smart Maritime Technology Solutions (2017). <https://www.finnishmaritimecluster.fi/research/>
4. European Union Maritime economy statistics (2015). https://ec.europa.eu/eurostat/statistics-explained/index.php/Archive:Maritime_economy_statistics_-_coastal_regions_and_sectoral_perspective
5. Reunanen, T., Röhr, T., Holopainen, T., Schneider-Störmann, L., Görne, J.: On the basis of the sales engineering competences and education. In: *Advances in Human Factors, Business Management*, pp. 160–172. Springer (2018). https://doi.org/10.1007/978-3-319-60372-8_16
6. Helama, H., Piispanen, S.: Oppisopimus korkea-asteen koulutukseen Etelä-Savossa – alueellinen selvitys elinkeinoelämän valmiuksista korkea-asteen oppisopimuskoulutukseen. University of Helsinki (2009). ISBN 978-952-10-5405-1

7. Gröhn, I.: Vahvat osaamisketjut ja korkea-asteen oppisopimusmalli. – Gröhn, Irene (toim.) Näkökulmia korkea-asteen oppisopimuksen kehittämiseen. Haaga-Helia kehittämisraportteja 1/2009, pp. 115–136. Haaga-Helia ammattikorkeakoulu, Helsinki (2009). <http://www.haaga-helia.fi/sites/default/files/Kuvat-ja-liitteet/Palvelut/Julkaisut/nakokulmiakorkea-asteen.pdf>
8. Verkkovirta project: Project description (2017). <http://www.amkverkkovirta.fi/english>
9. The Federation of Finnish Entrepreneurs: Osaamisen ekosysteemi 2025: Kohti jatkuvan oppimisen järjestelmää (2018). https://www.yrittajat.fi/sites/default/files/sy_osaamisen_ekosysteemi_2025_0.pdf
10. Wissenschaftsrat (ed.): Empfehlungen zur Entwicklung des dualen Studiums – Positionspapier (2013). <https://www.wissenschaftsrat.de/download/archiv/3479-13.pdf>. Drucksache 3479-13, Mainz
11. Bundesinstitut für Berufsbildung (ed.): AusbildungPlus - Duales Studium in Zahlen 2016 - Trends und Analysen. Bonn (2017). ISBN 978-3-96208-011-2. https://www.bibb.de/dokumente/pdf/59df505289ed7_bibb_09-282_ausbildungplus_barrierefrei_korr_urn.pdf
12. Przywara, R.: Dual study paths in engineering sciences - how to improve learning efficacy by integrating professional practice in academic education. In: Meerman, A., Kliewe, T. (eds.) Academic Proceedings of the 2014 University-Industry Interaction Conference: Challenges and Solutions for Fostering Entrepreneurial Universities and Collaborative Innovation (2014). ISBN: 978-94-91901-11-9
13. Schneider-Störmann, L., Röhr, T., Jaskari, R., Holopainen, T., Reunanen, T.: Enhanced higher education - industry cooperation improving work capabilities of sales engineering graduates. In: AHFE 2019 – 10th International Conference on Applied Human Factors and Ergonomics (2019, submitted)
14. Nonaka, I., Takeuchi, H.: The Knowledge Creating Company: How Japanese Companies Create the Dynamics Innovation. Oxford University Press, Oxford, UK (1995)

**Business Management and Society:
Market Views**



Customer Experience in Online-Retailing – An Analysis of the Main Segments in German Online-Retailing

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Abstract. In line with the continuous growth rates in online retailing, the competitive situation for retailers has intensified. In order to strengthen their market position and exploit further potential, online retailers need to create a strong customer experience. The objective of the paper is to analyze the customer experience at the largest German online retailers with the aim of finding out whether the main four segments (marketplaces, generalists, fashion, consumer electronics) differ with respect to customer experience.

This study is based on extensive qualitative (focus groups) and quantitative research (a representative sample of 1,000 German online buyers). The construct “customer experience” was conceptualized and operationalized as a multidimensional construct with five dimensions: customer’s cognitive, fulfillment-related, affective, social and sensorial experience.

The data from the quantitative survey were analyzed using exploratory and confirmatory factor analysis as well as a structural equation model. Looking at the five individual dimensions, there are significant differences between the four industry segments for four of the dimensions, namely cognitive, fulfillment-related, affective and social customer experience. With regard to the sensorial experience dimension, there are no significant differences.

Keywords: Customer experience · Cognitive dimension ·
Fulfillment-related dimension · Affective dimension · Social dimension ·
Sensorial dimension

1 Introduction

Customer experience is often considered the deciding factor when it comes to business competition [1]. The need to differentiate is especially pronounced in the online retail world, where the intense competition for customers in increasingly concentrated markets dominates [2]. When managing online retail shops, it is therefore important to understand the factors influencing the creation of a positive customer experience. By examining the meaning of different experience dimensions from the customer’s point of view, this paper provides an important contribution to this field.

The objective of the paper is to analyze the customer experience at the largest German online retailers, clustered into four industry segments. Specifically, the paper addresses the following research questions:

- How can the construct “customer experience” be conceptualized and operationalized in online commerce?
- Are there differences in the online “customer experience” between the four online retailing segments: marketplaces, generalists, fashion and consumer electronics? If so, which ones?

2 Conceptual Framework and Hypotheses

2.1 Customer Experience

Lemon and Verhoef [3] define customer experience as “a multidimensional construct focusing on a customer’s cognitive, emotional, behavioral, sensorial, and social responses to a firm’s offerings during the customer’s entire purchase journey” [3]. The works of Gentile et al. [4], Bruhn and Hadwich [5] and Verhoef et al. [6] are central to the conceptual underpinnings of this research, while the observations gleaned from the four focus groups are also of strong importance. The customer experience is treated as a second-order construct exhibiting a total of five dimensions: cognitive, fulfillment-related, affective, sensorial and social. The behavioral dimension was assessed such that only customers of specific online retail shops were surveyed about their customer experience there.

The *cognitive dimension* describes a customer’s conscious mental engagement with the retailer’s offering, in which the perception of price and product selection play a substantial role [7, 8].

In the realm of online commerce, the issue of ‘fulfillment’ also plays an important role for the range of services a retailer offers. Although this aspect has yet to be covered in the literature, because of the observations made during the focus groups and pre-test, ‘fulfillment-related’ was added to the list of cognitive dimensions assessed in this research.

The *affective dimension* covers the emotions and feelings arising in the customer through interactions with the retailer [7–9]. For example, a customer’s relation to a specific retail brand can elicit positive feelings. Trust in the retailer also plays a role in this dimension [7].

The *sensorial dimension* handles the stimulation of the customer’s senses resulting from external stimuli. In the e-commerce retail space, the website design’s use of visual stimulation is paramount [9, 10]. The usability of the online shop is also perceived within this dimension [7, 11].

The *social dimension* incorporates above all the interactions between customer and company as well as the possibility of customer-to-customer interaction. The consultation competencies and level of customer service offered by the retailer are noteworthy aspects for this dimension [11–13].

The measurement of individual experience dimensions is followed up by a direct survey of the general customer experience based on the customer experience pyramid by Forrester Research, according to which the customer experience covers three levels. First, the needs of the customer must be met. Additionally, the customer should perceive the interaction with the company as uncomplicated and shopping with the retailer a pleasant activity [14].

2.2 Research Object: Germany's Main Online Retailing Segments

In 2018, German online sales reached 65.10 billion euros [15]. The 10 best-selling online shops in Germany are the US marketplaces Amazon and eBay, followed by generalists like Otto and vertical players from the fashion segment and the consumer electronics sector [16].

In order to investigate possible differences in the construct “customer experience” between the different retail segments, 16 online shops were examined, which together represent over 60% of total online sales in Germany in 2018:

1. Marketplaces account for the highest-revenue online shops in Germany. They offer a platform on which numerous distributors can be active. Thanks to a large supply of retailers, marketplaces are well-positioned to offer a wide selection of products. The range of services covered by the platform operator can vary [17]. Amazon occupies a unique role as both a marketplace operator and distributor, accounting for approximately 50% of all sales revenue on its own platform [18]. We studied the marketplaces Amazon and eBay.
2. Generalists offer products from a wide range of categories, e.g. fashion, entertainment electronics, household goods etc. In this research the following were studied: otto.de; galeria-kaufhof.de; lidl.de; qvc.de; tchibo.de.
3. Fashion: We studied the following highest-revenue shops zalando.de; bonprix.de; hm.com; esprit.de.
4. Consumer Electronics: In this research the following were studied: notebooksbilliger.de; mediamarkt.de; apple.com; saturn.de; medion.de.

The fashion and consumer electronic categories also include multi-brand retailers, such as Zalando, and vertical-industry retailers, such as Apple.

2.3 Development of Hypotheses

The online retail segments studied here demonstrate particular strengths and weaknesses as a result of their different industry affiliations and business models. We therefore expect several segments to offer customers a more positive customer experience than others, as measured both in terms of the individual experience dimensions and on the whole.

Hypothesis 1 (H1): Marketplaces and generalists score higher on the cognitive dimension than retailers using other retail formats.

Largely independent from individual brands, generalists such as Otto or marketplaces such as Amazon are able to offer a comparatively broad and comprehensive product

selection, which can have an effect on the customer's perception of the price/performance ratio.

Hypothesis 2 (H2): Marketplaces score lower on the fulfillment dimension than retailers using other retail formats.

Many retailers sell a variety of products on marketplaces, usually in the form of smaller scale distributors who have less professional capacity to handle fulfillment and customer service related tasks than high revenue shops from other segments do. This shortcoming can present itself in longer delivery times and a less customer-friendly returns process.

Hypothesis 3 (H3): Fashion and consumer electronics shops score higher on the affective dimension than retailers using other retail formats.

Shops that only sell products in single vertical industries are able to craft a more concise, industry-relevant image.

Hypothesis 4 (H4): Fashion and consumer electronics shops score higher on the sensorial dimension than retailers using other retail formats.

It can be assumed that mono-branch shops with their homogenous product offerings have a relatively easier time creating a visually appealing design.

Hypothesis 5 (H5): Marketplaces score lower on the social dimension than retailers using other retail formats.

Many Marketplace retailers are less professionally equipped than other retailers. This is the case for customer service as well as personalized customer interfacing.

Hypothesis 6 (H6): There are differences in the general online "customer experience" between the four online retailing segments: marketplaces, generalists, fashion and consumer electronics.

2.4 Research Design

In a qualitative preliminary investigation, four focus groups with a total of 26 online shoppers were conducted (ages 19–72 and 50/50 male–female gender split). The aim was to discover how the construct "customer experience" can be conceptualized and operationalized in online commerce. The questionnaire was then pre-tested with 60 individuals. We measured customer experience along a five-step Likert Scale from 1 = "Strongly Disagree" up to 5 = "Strongly Agree."

The quantitative data of the main research was obtained from a representative sample of 1,000 German online buyers in February 2018 using an online panel. Representativeness refers to age (>18 years), gender and monthly household income (net). Customers were questioned about their customer experience only for the specific retailer with which they were familiar using. For each retailer, there was a total of 36 to 40 cases.

3 Research Results

3.1 Customer Experience

The suggested conceptualization and operationalization of the customer experience construct was assessed on the basis of an exploratory and confirmatory factor analysis using a multi-step process with regard to reliability and validity [19]. In the initial step, the dimensionality of the customer experience construct was tested. Using the 29 items in the experience dimensions of customer experience, we carried out a factor analysis (SPSS, Promax-Rotation) [20]. As a result of the exploratory factor analysis, we extracted five factors. All indicators showed *factor loadings* of ≥ 0.7 as well as *indicator reliability* of ≥ 0.5 . The results of the explorative factor analysis can be found in the appendix.

The subsequent step of the study consisted of a confirmatory factor analysis to test whether the factor loadings are significant and if the following criteria exceed the necessary minimum values: *factor reliability (FR)* ≥ 0.6 , *average variance extracted (AVE)* ≥ 0.5 , *Item-to-Total-Correlation (ITC)* $\alpha \geq 0.4$ and *Cronbach's Alpha (CA)* $\alpha \geq 0.7$. The results of the confirmatory factor analysis can be found in Table 1. On the whole, the analysis revealed satisfactory results. Tests for the Fornell-Larcker-Criterion and Heterotrait-Monotrait-Ratio (HTMT) were likewise met.

Table 1. Results of the confirmatory analysis (customer experience dimensions)

Dimension	Indicator	Factor loadings	ITC	CA	FR	AVE
		(≥ 0.7)	($\alpha \geq 0.4$)	(≥ 0.7)	(≥ 0.6)	(≥ 0.5)
Cognitive	K_1	0.771	0.659	0.840	0.942	0.565
	K_2	0.793	0.675			
	K_3	0.728	0.599			
	K_4	0.780	0.650			
	K_5	0.667	0.544			
	Se_7	0.745	0.608			
Fulfillment	F_1	0.762	0.643	0.873	0.937	0.711
	F_2	0.809	0.708			
	F_3	0.804	0.693			
	F_4	0.840	0.718			
	F_5	0.847	0.744			
Affective	A_1	0.877	0.829	0.921	0.975	0.687
	A_2	0.866	0.812			
	A_3	0.780	0.713			
	A_4	0.834	0.764			
	A_5	0.819	0.749			
	A_6	0.782	0.696			
	Se_3	0.818	0.756			

(continued)

Table 1. (continued)

Dimension	Indicator	Factor loadings	ITC	CA	FR	AVE
		(≥ 0.7)	($\alpha \geq 0.4$)	(≥ 0.7)	(≥ 0.6)	(≥ 0.5)
Sensorial	Se_1	0.805	0.725	0.901	0.955	0.723
	Se_2	0.871	0.807			
	Se_4	0.869	0.788			
	Se_5	0.838	0.754			
	Se_6	0.820	0.725			
Social	So_1	0.814	0.769	0.921	0.962	0.908
	So_2	0.825	0.772			
	So_3	0.806	0.767			
	So_4	0.852	0.773			
	So_5	0.871	0.806			
	So_6	0.854	0.766			

The suggested conceptualization and operationalization of the general “customer experience” construct was similarly tested, the results of which are listed in Table 2.

Table 2. Results of the confirmatory analysis (general experience dimensions)

Dimension	Indicator	Factor loadings	ITC	CA	FR	AVE
		(≥ 0.7)	($\alpha \geq 0.4$)	(≥ 0.7)	(≥ 0.6)	(≥ 0.5)
General customer experience	CE_1	0.887	0.832	0.924	0.941	0.737
	CE_2	0.845	0.774			
	CE_3	0.793	0.705			
	CE_4	0.880	0.821			
	CE_5	0.850	0.776			
	CE_6	0.855	0.786			

3.2 Hypothesis Testing

Figure 1 is a graphical depiction of the mean values of the customer experience dimensions as well as the mean values of the general customer experience in the researched segments.

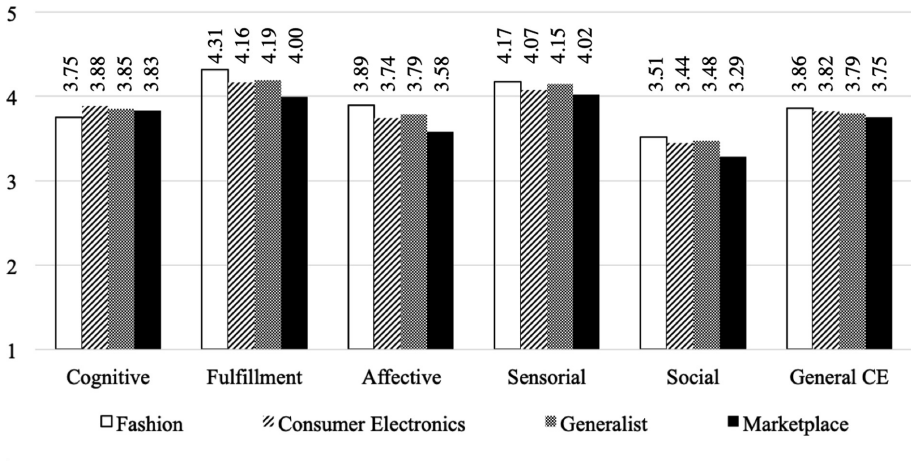


Fig. 1. Mean values of the customer experience (individual dimensions and general)

The hypotheses were tested using the Mann-Whitney-U-Tests, the results of which can be seen in Table 3.

Table 3. Summary of Mann-Whitney-U-Tests (significance value)

Segment	n	Significance Mann-Whitney-U-Tests					
		Dimensions					
		Cognitive	Fulfillment	Affective	Sensorial	Social	General customer experience
Fashion	179	0.039	0.077	0.087	0.309	0.635	0.927
CE	209						
Fashion	179	0.103	0.224	0.263	0.837	0.794	0.468
Gen.	232						
CE	209	0.683	0.567	0.554	0.217	0.813	0.519
Gen.	232						
Fashion	178	0.159	0.000	0.001	0.135	0.032	0.345
MP	143						
CE	209	0.736	0.040	0.087	0.557	0.100	0.395
MP	143						
Gen.	232	0.961	0.010	0.026	0.106	0.069	0.758
MP	143						

CE = Consumer Electronics; MP = Marketplaces

Cognitive Dimension: Reject H1

In terms of the cognitive dimension of customer experience, online shops in the consumer electronics department perform the best while those in the fashion department

perform the worst. A possible explanation for this is that the technical nature of consumer electronics products allows them to be itemized precisely, easily providing customers with the most relevant product information for making a purchasing decision.

Fulfillment: Upheld H2

As hypothesized, marketplaces demonstrate significantly lower values on the fulfillment dimension than do retailers from fashion, consumer electronics and generalist categories. Furthermore, we noted a weak but significant difference between the fashion and consumer electronics segments. The considerably higher return rate in fashion retail compared to other online-commerce industries most probably plays a role in this. Fashion retailers are also found to be more accommodating with returns than their equivalents in other departments [21].

Affective Dimension: Partially Reject H3

Unlike the consumer electronics segment, the fashion segment achieves better values in the affective dimension. We observed significant differences in the affective dimension between fashion and consumer electronics, fashion and marketplaces, consumer electronics and marketplaces as well as generalists and marketplaces.

Taking a closer look at the fashion and consumer electronics industries, it becomes apparent that customers rate the overall experience of purchasing clothing online as more enjoyable than purchasing electronics. A possible reason for this could be that customers are more inclined to feel inspired when shopping for apparel than when purchasing electronics [22].

Sensorial Dimension: Reject H4

No significant differences were found between the different segments for the sensorial dimension. Even with regard to website design as well as functionality and usability, customers perceive no difference between the market segments.

Social Dimension: Partially Reject H5

Marketplaces show significantly lower values in this area than generalists. Fashion retailers perform significantly better than marketplaces. As with the other dimensions, we suspect the presence of different retailers and distributors on one platform to be an explaining factor.

General Customer Experience: Reject H6

When looking at the customer experience rating on the whole, we found no significant differences between retailers of different segments. While retailers in fashion and consumer electronics are on average better rated than generalists and marketplaces, the difference in the individual experience dimensions do not suffice to observe a significant value for the holistic customer experience.

4 Discussion and Limitations

To date researchers have not addressed the important question yet, whether different online retailing segments differ with regard to their customer experience. The study presented here conceptualizes and operationalizes the customer experience construct as

a second-order construct comprising five dimensions: cognitive, fulfillment-related, affective, sensorial and social. Over the course of the analysis of the structural model, it became apparent that affective and social experience dimensions are important for creating a positive customer experience. Companies that do well in these dimensions therefore enjoy an advantage over the competition. In both of these dimensions, marketplaces perform the worst and fashion retailers the best, meaning such retailers should draw on these strengths when facing competition from marketplaces such as Amazon or eBay.

When looking at the general customer experience ratings, no significant differences are found between the retailers of the different segments. This indicates that the differences in individual experience dimensions may cancel each other out in the overall assessment.

Naturally, our study carries certain limitations. With regard to the results of the group comparison, it should be noted that these are crucially influenced by which online shops we selected for this study. To enable an objective analysis, we resorted to studying the retailers demonstrating the highest revenue rates in German online commerce for their respective market segments. Nevertheless, it is important to consider that differences in customer experience exists among retailers of the same segment that are attributable to the companies themselves. Further analyses should study whether there are differences among individual retailers *within* a certain industry.

Regardless of the limitations noted above, this research marks an important contribution to the literature of empirical studies on customer experience in online retail. Against the backdrop of a growing e-commerce industry in Germany, as well as intensifying competition among retailers, the subject matter studied here will only gain in importance for science and practice in coming years. The work presented here provides a foundation upon which future researchers in this field are encouraged to build.

Appendix: Results of the Explorative Factor Analysis

Dimension	Indicator	Items	Factor loadings (≥ 0.7)	Explained variance (%) ($\geq 50\%$)
Cognitive	K 1	The product selection at X is optimal (not too big or too small)	0.771	55.99
	K 2	The products at X are of a good quality	0.793	
	K 3	X's products are cost effective	0.728	
	K 4	The information provided on the products is sufficient	0.780	
	K 5	X allows me to consider other customers' experiences when making a purchasing decision (customer reviews/product ratings)	0.667	
	Se 7	It is easy to compare products	0.745	

(continued)

(continued)

Dimension	Indicator	Items	Factor loadings (≥ 0.7)	Explained variance (%) ($\geq 50\%$)
Fulfillment	F 1	X offers suitable payment options	0.762	66.12
	F 2	X offers suitable shipping options (alternative shipping addresses, choice of delivery time)	0.809	
	F 3	The shipping service at X is all around good (cost, duration, packaging)	0.804	
	F 4	Returning purchased items is uncomplicated	0.840	
	F 5	The process for returning items works well (receipt notification, refund)	0.847	
Affective	A 1	Shopping at X is an enjoyable experience	0.877	68.18
	A 2	Shopping at X is fun	0.866	
	A 3	I feel safe providing my personal information	0.780	
	A 4	I trust X	0.834	
	A 5	On the whole, I hold a positive opinion of X	0.819	
	A 6	Shopping at X is an escape from my daily worries	0.782	
Sensorial	Se 3	X appeals pleasantly to my senses	0.818	67.50
	Se 1	I think the website design is appealing	0.805	
	Se 2	The structure and setup of X's website is clear	0.871	
	Se 4	The website is easy to use	0.869	
	Se 5	The website functions well (Loads quickly, good search function)	0.838	
Social	So 6	It is easy to place an order	0.820	70.10
	So 1	X suggests products that match my needs	0.814	
	So 2	X sends me advertisements and deals that are appropriate for my situation/needs	0.825	
	So 3	X makes me feel unique as a customer	0.806	
	So 4	Customer service personnel are helpful and accessible	0.852	
	So 5	X handles complaints well	0.871	
General customer experience	So 6	Customer service is easy to reach when questions or problems arise	0.854	72.64
	CE_1	X exactly meets my needs	0.887	
	CE_2	X offers everything I need	0.845	
	CE_3	Shopping at X is altogether easy	0.793	
	CE_4	X does everything to make life easier for me as a customer	0.880	
	CE_5	As a customer, I always feel welcome at X	0.850	
	CE_6	X is constantly getting better at what they do for their customers	0.855	

Note: X stands for the researched retailer

References

1. Palmer, A.: Customer experience management: a critical review of an emerging idea. *J. Serv. Mark.* **24**(3), 196–208 (2010)
2. EHI: E-Commerce-Markt Deutschland 2017, Köln (2017)
3. Lemon, K.N., Verhoef, P.C.: Understanding customer experience throughout the customer journey. *J. Mark.* **80**(6), 69–96 (2016)
4. Gentile, C., Spiller, N., Noci, G.: How to sustain the customer experience: an overview of experience components that co-create value with the customer. *Eur. Manag. J.* **25**(5), 395–410 (2007)
5. Bruhn, M., Hadwich, K.: Customer experience: Eine Einführung in die theoretischen und praktischen Problemstellungen. In: Bruhn, M., Hadwich, K. (eds.) *Customer Experience: Forum Dienstleistungsmanagement*, pp. 3–36. Springer, Wiesbaden (2012)
6. Verhoef, P., Lemon, K.N., Parasuraman, A.P., Roggeveen, A., Tsiros, M., Schlesinger, L.A.: Customer experience creation: determinants, dynamics and management strategies. *J. Retail.* **85**, 31–41 (2009)
7. Bruhn, M., Mayer-Vorfelder, M.: Kundenerfahrung als Forschungsgegenstand im Marketing – Konzeptionalisierung, Operationalisierung und empirische Befunde. *WWZ Discussion Paper 2011/01* (2011)
8. Huddleston, P., Whipple, J., Nye Mattick, R., Lee, S.J.: Customer satisfaction in food retailing: comparing speciality and conventional grocery stores. *Int. J. Retail Distrib. Manag.* **37**(1), 63–80 (2009)
9. Schwertfeger, M.: *Einkaufserlebnisse im Handel: Theoretische Konzeption und empirische Analyse*. Gabler Verlag, Wiesbaden (2012)
10. Rose, S., Hair, N., Clark, M.: Online customer experience: a review of the business-to-consumer online purchase context. *Int. J. Manag. Rev.* **13**, 24–39 (2011)
11. Garg, R., Rahman, Z., Qureshi, M.N.: Measuring customer experience in banks: scale development and validation. *J. Model. Manag.* **9**(1), 87–117 (2014)
12. Yang, Z.-Y., He, L.-Y.: Goal, customer experience and purchase intention in a retail context in China: An empirical study. *Afr. J. Bus. Manag.* **5**(16), 6738–6746 (2011)
13. Chang, H.H., Chen, S.W.: The impact of customer interface quality, satisfaction and switching costs on e-loyalty: Internet experience as a moderator. *Comput. Hum. Behav.* **24**(6), 2927–2944 (2008)
14. Forrester Research. <http://www.tandemseven.com/wp-content/uploads/2015/04/Customer-Experience-Index-2014.pdf>
15. bevh. <https://www.bevh.org/presse/pressemitteilungen.html>
16. Statista/EHI. <https://de.statista.com/infografik/642/top-10-online-shops-in-deutschland-nach-umsatz/>
17. Morschett, D.: Distanzhandel – Online-Shops und andere Formen. In: Zentes, J., Swoboda, B., Morschett, D., Schramm-Klein, H.: *Handbuch Handel: Strategien – Perspektiven – Internationaler Wettbewerb* (2. Auflage), pp. 375–398. Springer, Wiesbaden (2012)
18. t3n. <https://t3n.de/news/amazon-erzeugt-2017-rund-53-934948/>
19. Homburg, C., Giering, A.: Konzeptualisierung und Operationalisierung komplexer Konstrukte: Ein Leitfaden für die Marketingforschung. *Marketing: Zeitschrift für Forschung und Praxis*, vol. 18, no. 1, pp. 5–24 (1996)

20. Obermaier, G.: Research-to-Business-Beziehungen: Technologietransfer durch Kommunikation von Werten (Barrieren, Erfolgsfaktoren und Strategien). KIT Scientific Publishing, Karlsruhe (2009)
21. Handelsverband Deutschland. de.statista.com/statistik/daten/studie/717465/umfrage/online-umsatz-nachbranchen-in-deutschland
22. IFH Köln. https://www.hsh-nordbank.de/media/pdf_3/marktberichte/branchenstudien/handel_ernaehrung/2017-09_leseprobe_fashionstudie_hsh_nordbank.pdf



Assessing the Sustainability of Crowdfunding in Social Media and Google Trends

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Abstract. This paper aims to assess the degree to which sustainability, namely, economic, social, environmental and institutional dimensions are integrated within the public discourse on crowdfunding in social media and in Google Trends. The utilizing Social Media Analytics and Google Trends search queries, respectively, we track discussions on crowdfunding in user-generated content published in social media and analyse the Google Trends queries. Quantitative methodology, namely, multivariate analysis and econometric models was used, in order nowcast the insights about the importance of the sustainability dimensions in the crowdfunding. The results show an interesting trend of increasing popularity search terms in sustainability dimensions as a *proxi* of marketing strategies to involve the participants in the crowdfunding projects.

Keywords: Business models · Crowdfunding · Google trends · Social media · Social media analytics · Sustainability

1 Introduction

In the last decade, the way of financing innovative and entrepreneurial projects has radically changed from the traditional forms of financing such as bank loans, funds, business angels among others, by the emergence and development of crowdfunding platforms, namely, online platforms through which individuals and companies aim at

funding their projects by means of open calls, in exchange for rewards, equity, other monetary benefits, or simply an acknowledgment [1–3]. Also, during the last decade there is an increasing interest of the literature about crowdfunding. Results from [4] show an increasing rate of 4500% from publications about crowdfunding on economics/management and social sciences areas.

Besides this development, while crowdfunding platforms have a well-managed, well-managed structure based on profit maximization, the majority of crowdfunding developers and the sponsors don't have any management and marketing experience and acting on their own behalf same campaigns through social media, usually in closed groups [5].

Although, there are an extensive and increasing list of referred publications about crowdfunding in economics, business and social sciences there are few references to the sustainability of the crowdfunding on the media platforms and social media with exception of [3], [5] and the few references from [6–8]. More specifically [3] had systematically analyzed data from social media concerning the interplay between sustainability and crowdfunding. But no one of the papers was analysed the sustainability by the Google Trends or analyse the institutional component of sustainability of the crowdfunding. This study tries to overcome this gap on the literature.

More specifically, this paper aims to:

- (a) To analyze the path of development of the crowdfunding at world level and infer if that development is related with sustainability;
- (b) To analyze the current development of the sustainability of the crowdfunding at world level and infer if these presents trend of growth in economics; social; environmental and institutional;

This paper making a threefold contribution in the literature:

- (1) Besides the many development of crowdfunding the reference of sustainability of crowdfunding just remain rare. This paper tries to contribute to the literature in that way;
- (2) This paper uses Google Trends for the first time as data search and also the analysis of Social Media about crowdfunding;
- (3) The paper for the first time analyses the institutional component of the sustainability. The traditional analysis of sustainability usually uses just the three components, namely, economics, social and environmental. But the institutional framework of crowdfunding gives new insights to the research, to the stakeholders and to public decision-makers about the way forward in the promotion and development of the sustainable crowdfunding.

2 Literature Review

Crowdfunding is nowadays a new practice for financing projects that has gained popularity in the last decade [9]. It is defined as “an open call”, on the professional platforms mainly by the Internet, for the provision of financial resources either in form of donation or in exchange for some form of reward and/or voting rights in order to

support initiatives for specific purposes [9] and [10]. An emerging stream of research confirms that crowdfunding can be a new source of value creation [11–14].

On the other hand, in the Internet era it is undeniable that Internet-based platforms create a crucial role in the rise of the crowdfunding phenomenon as fundraising activities are no longer confined to the geographical area where the creator of the project operates, but it becomes available worldwide for any able to access a crowdfunding platform [2, 15] and [5]. In this respect, crowdfunding supports democratization entrepreneurship and access to business finance [16] and [5].

The importance of the sustainable dimensions of the crowdfunding was also referred by many authors have highlighted the potential of crowdfunding, suggesting that it can allow economic growth that encompasses both social and environmental needs [17] and [5]. Crowdfunding can potentially have direct consequences sustainability due to the innovative application of networking [18]. In addition, crowdfunding is particularly interesting for environmental initiatives, as it offers to combine the pursuit of profit with the ability to lead the environment [19]. Small and young companies were considered much better in incorporating sustainability as part of its business model [20].

3 Materials and Methods

3.1 Data

Data was collected from two different forms: (1) The first was based on the social media Facebook. In that case the collection data on a dairy baseline from 1 October 2018 to final of January 2019. In the present at the beginning we search groups at Facebook related with the word “Crowdfunding”. We find a vast and diverse number of groups that fulfil this word. The majority of the groups were closed. We ask for permission from about 150 closed groups that have the “crowdfunding” as a title. After in average 15 days our request was allowed, and we are invited to see the information among the “closed members of the group”. The main goal is collecting terms referred to sustainability in social; economics; environmental and institutional.

The second way of collecting data was done by Google Trends search [21] and the data search includes: (1) Google Trends (GT) data was collected online [21] from the 2004 to the final year of 2018 at a monthly baseline. The choice of keywords and terms to search in GT is, crucial for any study [22–24]. This search was used to analyze the online interest on the terms crowdfunding and crowdfunding related words of sustainability, namely, “Crowdfunding” (C), “crowdfunding economics” (CE), “equity crowdfunding” (EC) “social crowdfunding” (SC), and, “environmental crowdfunding” (ENC). We don’t use the term institutional, because this analysis was done mainly by the crowdfunding platforms analysis. The search was done at world level, and multiples choices of combination of world search related with sustainability of crowdfunding were eliminated due the absence of data at world level. However, around the world there are few data isolated by country, in some years/months, but not in a permanent way to form a trend of analysis. The search includes at first “all the categories at the

Google Trends (web pages; news; shopping and YouTube) and after includes just “google chopping” in order to infer about commercial importance of crowdfunding.

3.2 The Sample

The sample size of the “Facebook closed groups on Crowdfunding” was determined by the ungrouped-on stage random likelihood sampling method according to [25], and [24]:

$$n = (t2 * p * q) / E2 \tag{1}$$

where:

- n - the sample size
- t - the significance level (assumed to be 90%)
- p - the probability of the topic being searched (for the present study the probability assumed is 50%)
- q - the probability of the participants on crowdfunding campaign ($1 - p$)
- E - the accepted statistic error (assumed to be 10%)

3.3 Methods

To analyse the integration of the dimensions of the sustainability of the crowdfunding in the public discourse on crowdfunding in Social Media, Social Media Analytics (SMA) was employed according to [3].

To explore the sustainable orientation dimensions within the crowdfunding Google Trends search we use the percentalized hits associated.

Let $C_{it}; CE_{it}; EC_{it}; SC_{it};$ and ENC_{it} be the weekly hits of the downloaded Google Trends data for the terms “Crowdfunding” (C), “crowdfunding economics” (CE), “equity crowdfunding” (EC) “social crowdfunding” (SC), and, “environmental crowdfunding” (ENC). Searches of the i -th region and time, with representative data along time and countries, where:

$C_{tpi}; CE_{tpi}; EC_{tpi}; SC_{tpi};$ and ENC_{tpi} define, respectively, the percentalized weekly hits of their respective normalized Google searches, using Eqs. (2–6) according to [23].

$$C_{tpi} = \frac{C_{it}}{C_{it} + CE_{it} + EC_{it} + SC_{it} + ENC_{it}} \tag{2}$$

$$CE_{tpi} = \frac{CE_{it}}{C_{it} + CE_{it} + EC_{it} + SC_{it} + ENC_{it}} \tag{3}$$

$$EC_{tpi} = \frac{EC_{it}}{C_{it} + CE_{it} + EC_{it} + SC_{it} + ENC_{it}} \tag{4}$$

$$SC_{tpi} = \frac{SC_{it}}{C_{it} + CE_{it} + EC_{it} + SC_{it} + ENC_{it}} \tag{5}$$

$$ENC_{pi} = \frac{ENC_{ii}}{C_{ii} + CE_{ii} + EC_{ii} + SC_{ii+ENC_{ii}}} \quad (6)$$

Due the limited information about the components of sustainability the multivariate methods weren't used. In order to analyze the general trend of sustainability of crowdfunding was used the general simple autoregressive models augmented by the Google Trends [26] and [24]:

$$Y_t = \alpha_0 + \alpha_1 y_{t-1} + \alpha_2 y_{t-12} + \beta X_t + \gamma \text{TREND} \quad (7)$$

where y_t is the value of the series under investigation in month t ; y_{t-1} is the value of that series in the previous month; y_{t-12} is the value of the series 12 months earlier; and x_t is the value of the Google Trends query index for the term associated with the series that included a normal time trend (TREND) and the value of the relevant search term (labelled x in general) [27] and [24].

4 Results and Discussion

4.1 Results from Social Media Analysis

The results from social media analysis are composed by the analysis of the social media “private groups” at Facebook and content analysis (Table 1).

Table 1 Identified hashtags in Facebook and associated frequency per sustainability dimension.

Sustainability dimension	Hashtags	Frequency
Economics	#equity	28
	#money	35
	#withdrawal	26
	Bitcoin	10
Social	#helpme	56
	#health	58
	#cancer	54
	#education	24
Environmental	#green	12
	#organicfood	15
	#clean	12
	#greenlightyourself	
Institutional	#financialfreedom	14
	#millions	45
	#platform	21

4.2 Results from Google Trends Search

Results of the crowdfunding Google trends percentilized terms prove that just the term “crowdfunding” revels importance just from 2014, while the others percentilized terms, namely, CE, EC, SC, and ENC don’t have relevant results. Before that from 2004 to 2014 all the searched terms don’t have statistical importance. Besides that, the results also confirm that “crowdfunding” Google trends search presents an increasing trend (Fig. 1).

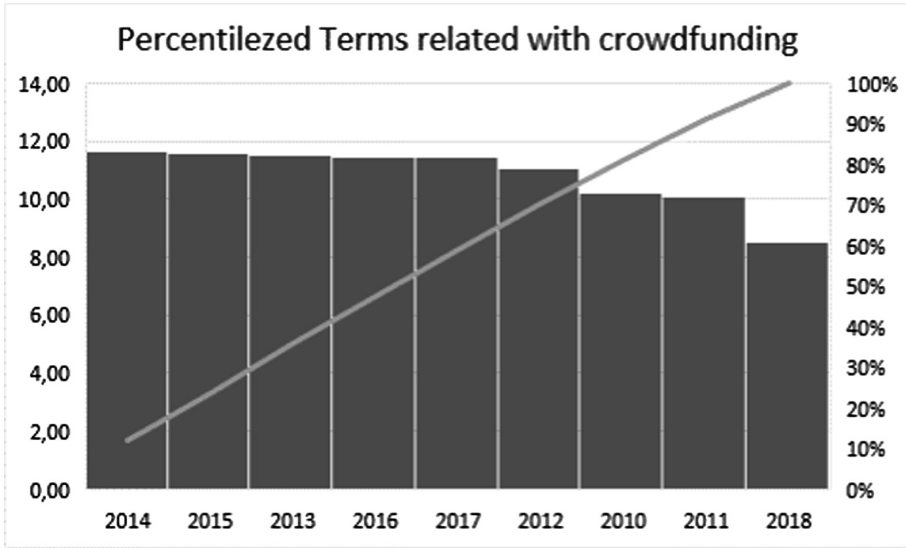


Fig. 1 Percentilized terms “crowdfunding”; Crowdfunding Equity; “Economics crowdfunding”; “Social crowdfunding” “environmental crowdfunding”. Source: Results of the authors, 2018.

The absences of search queries about the terms related with economic; social and environmental crowdfunding don’t allow develop the econometric model general simple autoregressive. The results just show an increasing linear trend:

$$Y_y = \alpha + \beta X_t + \varepsilon_{it} \tag{8}$$

$$Y_t = 0.0712 + 0.085X_t + \varepsilon_{it} \tag{9}$$

With:

R^2 Adjusted	0.75
Prob > t	0.0007(**)

(**) at 0.001

Besides the good adjustment from the model to the data that confirms an increasing trend of grows just for crowdfunding search and importance. That results were also confirmed by [4].

5 Conclusion

Besides the increasing importance at research level; at business and at social media the development of sustainable crowdfunding and the direct reference of economics; social and environmental parts of sustainability are still rare in crowdfunding. However, results from Social Media also show an interesting trend of increasing popularity in the crowdfunding search terms in sustainability dimensions as a *proxi* of marketing strategies to involve the participants in the crowdfunding projects. The institutional component is present mainly at the platforms and the economics terms are present more in informal groups of Social Media.

References

1. Belleflamme, P., Lambert, T., Schwienbacher, A.: Crowdfunding: tapping the right crowd. *J. Bus. Ventur.* **29**(5), 585–609 (2014)
2. Mollick, E.: The dynamics of crowdfunding: an exploratory study. *J. Bus. Ventur.* **29**(1), 1–16 (2014)
3. Laurell, C., Sandström, C., Suseno, Y.: Assessing the interplay between crowdfunding and sustainability in social media. *Technol. Forecast. Soc. Chang.* (2018)
4. SCOPUS Database. Crowdfunding search in Social Sciences/Economics/Business in the last decade. <https://www.scopus.com/home.uri>. Accessed 20 Jan 2019
5. Petruzzelli, A.M., Natalicchio, A., Panniello, U., Roma, P.: Understanding the crowdfunding phenomenon and its implications for sustainability. *Technol. Forecast. Soc. Chang.* (2018)
6. Calic, G., Mosakowski, E.: Kicking off social entrepreneurship: how a sustainability orientation influences crowdfunding success. *J. Manag. Stud.* **53**(5), 738–767 (2016)
7. Hörisch, J.: ‘Think big’ or ‘small is beautiful’? An empirical analysis of characteristics and determinants of success of sustainable crowdfunding projects. *Int. J. Entrep. Ventur.* **10**(1), 111–129 (2018)
8. Vasileiadou, E., Huijben, J.C.C.M., Raven, R.P.J.M.: Three is a crowd? Exploring the potential of crowdfunding for renewable energy in the Netherlands. *J. Clean. Prod.* **128**, 142–155 (2016)
9. Borst, I., Moser, C., Ferguson, J.: From friendfunding to crowdfunding: relevance of relationships, social media, and platform activities to crowdfunding performance. *New Media Soc.* **20**(4), 1396–1414 (2018)
10. Schwienbacher, A., Larralde, B.: Crowdfunding of small entrepreneurial ventures. In: Cumming, D. (ed.) *Handbook of Entrepreneurial Finance*, pp. 369–391. Oxford University Press, New York (2012)
11. Aitamurto, T., Landemore, H.E.: Five design principles for crowdsourced policymaking: assessing the case of crowdsourced off-road traffic law in Finland. *J. Soc. Media Org.* **2**(1), 1–19 (2015)
12. Burtch, G., Ghose, A., Wattal, S.: The hidden cost of accommodating crowdfunder privacy preferences: a randomized field experiment. *Manage. Sci.* **61**(5), 949–962 (2015)
13. Davidson, R., Poor, N.: The barriers facing artists’ use of crowdfunding platforms: personality, emotional labor, and going to the well one too many times. *New Media Soc.* **17**(2), 289–307 (2015)
14. Hills, M., Veronica, M.: Fandom, and the ‘Affective Economics’ of crowdfunding poachers. *New Media Soc.* **17**(2), 183–197 (2015)

15. Agrawal, A.K., Catalini, C., Goldfarb, A.: Crowdfunding: geography, social networks, and the timing of investments. *J. Econ. Manag. Strateg.* **24**(2), 253–274 (2015)
16. Aldrich, H.E.: The democratization of entrepreneurship? Hackers, makerspaces, and crowdfunding. In: *Academy of Management Annual Meeting*, Philadelphia, August 4 (2014)
17. Bartenberger, M., Leitner, P.: Crowdsourcing and crowdfunding: approaches to foster social innovation. In: *Proceedings of the IADIS International Conference Web Based Communities and Social Media*, vol. 2013. pp. 81–85 (2013)
18. Goodman, A., Polycarpou, L.: The sustainability-social networking nexus. *Sustain. J. Rec.* **6** (1), 26–32 (2013)
19. Bonzanini, D., Giudici, G., Patrucco, A.: The crowdfunding of renewable energy projects. In: Ramiah, V., Gregoriou, G.N. (eds.) *Handbook of Environmental and Sustainable Finance*, pp. 429–444 (2015)
20. Schaltegger, S., Wagner, M.: Sustainable entrepreneurship and sustainability innovation: categories and innovation. *Bus. Strateg. Environ.* **20**(4), 222–237 (2011)
21. Google Trends database. <https://trends.google.pt/trends/?geo=PT> (2019). Accessed 20 Jan 2019
22. Fondeur, Y., Karamé, F.: Can Google data help predict French youth unemployment? *Econ. Model.* **30**, 117–125 (2013)
23. Dos-Santos, M.J.P.L.: Predicting the present and future of aquaponics with Google Trends. In: *Proceedings 10th Annual Conference EuroMed Academy of Business, Global and National Business Theories and Practice: Bridging the Past with the Future*. Faculty of Economics, University of Rome Sapienza, Rome, Italy, de 13–17 de setembro de 2017, pp. 1998–2003, EuroMed Press (2017). ISSN 2547-8516
24. Dos Santos, M.J.P.L.: Nowcasting and forecasting aquaponics by Google Trends in European countries. *Technol. Forecast. Soc. Chang.* **134**, 178–185 (2018)
25. Kilic, T., Carletto, C., Miluka, J., Savastano, S.: Rural nonfarm income and its impact on agriculture: evidence from Albania. *Agric. Econ.* **40**(2), 139–160 (2009)
26. Choi, H., Varian, H.: Predicting the present with Google Trends. *Econ. Rec.* **88**, 2–9 (2012)
27. Hand, C., Judge, G.: Searching for the picture: forecasting UK cinema admissions using Google Trends data. *Appl. Econ. Lett.* **19**(11), 1051–1055 (2012)



Knowledge Management Model to Support a Supply Chain for Timely Order Delivery in a Telecommunications Equipment Marketing Company

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Abstract. Over the years, the telecommunications sector has steadily grown in the last ten years while gaining relevance in the global market. Management of the supply chain generates various risks and complications, and many industries seek effective supply chain operation methods to meet their variable requirements. The objective of this research is to propose a supply-chain model focused on on-time delivery compliance with substantial support of knowledge management methodologies. The research study yielded a 91% increase in compliance from the given scenario.

Keywords: Supply chain · Telecommunications · Agility · Order fulfillment

1 Introduction

Supply chains are currently renowned for demand variability in terms of short and long-term variations, i.e., the speed of change in market requirements. Hence, greater response capacity is required to reach an appropriate competitive level [1]. Also, in technology and telecommunications market, a business strategy that can easily adapt to the continuous changes that commonly occur in environments of this nature is needed [2].

The growth of the telecommunications sector is mainly driven by progress in communication networks, underlying technologies for the services offered, and service privatization [3, 4]. In 2018, Gestión explained that the telecommunications sector and other information services in Peru grew by 8.02% in 2017, with telecommunications sector recording the highest growth. Likewise, according to the Peruvian Statistics Institute (INEI), the business sector grew by 1.93% in December 2017, where the sale

of telecommunications equipment related to mobile telephony, servers, network equipment, and infrastructure significantly increased. This sector is a significant participant in the economic development of the country; therefore, it represents a framework for relevant research.

This article is further structured as follows: Sect. 2 presents the research questions and a literature review methodology. Section 3 describes the model and its features and provides a brief discussion on the development of the model. Section 4 validates the proposed model. Finally, Sect. 5 summarizes the article and its conclusions.

2 State of the Art

2.1 Knowledge Management

Knowledge management is considered a competitive advantage facilitator in the business world [5]. Knowledge management transforms information and intellectual assets into lasting values by acknowledging the knowledge required for the management of day-to-day operations in an organization [5].

Knowledge management can be observed and applied in various market sectors. In the case study conducted by Colomo-Palacios et al. [6], it was observed that the use and application of knowledge management for the introduction and development of software tools played an important role in allowing the organization to meet its objectives such as project success and effective adoption of methodologies.

2.2 Supply-Chain Management

The supply chain is defined as the strategy used to improve the individual and collective performances within the organization of the same chain [7].

Photis et al. [8] defines inventories as organization assets with the purpose of gaining advantages to facilitate the continuous offering of the company's products or services. To streamline inventory management, several authors propose different solutions for securing the inventory numbers needed at the required time. Lagondimos, et al. describe the classic "EOQ" inventory management technique, which determines the quantity of order to minimize total costs [9].

Orders are fulfilled via different parts of the supply chain. In fact, it is one of the critical steps at warehouses and their participation in the order management cycle [10]. De Koster et al. [11] mentions how warehouses contribute to obtaining results for global companies. Warehouses provide support service for level policies, which facilitate meeting market conditions and uncertainties such as seasonality, demand fluctuations, and competitiveness. Therefore, achieving the right balance between reduction of logistics cost and optimal level of compliance.

Yan et al. [12] mentions storage management within the economic context and its rapid growth. Within storage management, the following factors are considered: purchase or production planning, inventory level review, order-picking, inventory, and storage policies [13].

3 Collaborations

In our literature review, we were able to find a number of articles that included some components within the proposed design. These components are found in three main design groups.

Figure 1 displays the proposal model that denotes the main factors and activities considered for implementing the proposed solution. This design describes the dimensions and components considered, the development of the two main management branches, and how this is covered by the solution techniques using the validation tools.

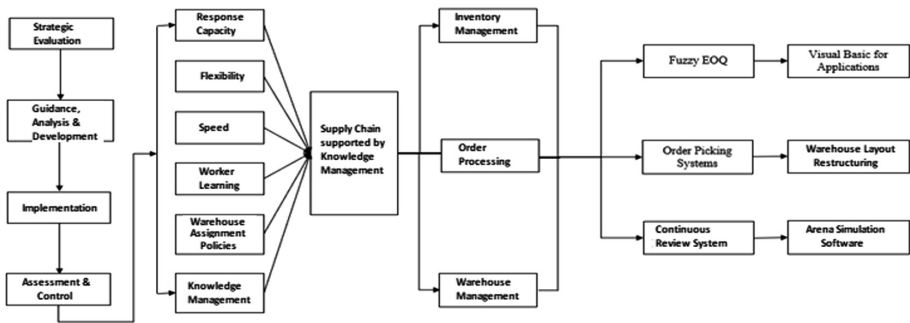


Fig. 1. Proposed model

3.1 Storage Management

Storage management includes flexibility, which is defined as the achievement of a goal via the implementation of various processes and the application of several resources [14]. Yu et al. [15] reflects on the ability to respond to changes via low values in variables such as time, resources, and costs.

Response capacity quickly identifies and responds to changes in the environment and is capable of quickly recovering from the effects of the presented variability. Cai et al. defines it as the ability to diagnose environmental changes and respond to them [16]. Response capacity is related to the concept of agility in the supply chain context.

Likewise, Ma et al. [17] argue that one of the variables that must be considered in agile supply chains is the response speed to customer orders and the changes caused by their characteristics or information details. With regard to policies, the levels considered within the storage context are: strategic, tactical, and operational [10]. In this component, the Fuzzy EOQ technique will be used.

Identification of Variables.

This technique focuses on establishing key variables for optimal development. For this, the study published by Kumar and Chanda was used as foundation [1] (Table 1).

Table 1. Variable classification.

Variable	
$\lambda(t)$	Current demand
A	Order costs per order
C	Costs per unit of time
I	Inventory load per unit of time
IC	Cost of inventory maintenance per unit of time
T	Cycle time
I(t)	Current inventory levels
$\gamma(t)$	Salvage values associated to deteriorated units
<i>Coefficient of Innovation</i>	
Q	Order quantity
K(T)	Total system costs

Formulas

The mathematical model aims to obtain the necessary values to develop a hybrid model of the EOQ technique, considering additional variables to the traditional model [1].

Calculation of Main Variables. The following formulas are used to calculate the optimum batch:

$$Q = \frac{\bar{N}p}{(\theta - p)} [e^{(\theta-p)T} - 1] \tag{1}$$

As for the calculation of total costs during the cycle, order costs, inventory maintenance costs per cycle, costs per material, and recovery value of deteriorated items are used.

$$K(T) = \frac{A}{T} + \frac{IC\bar{N}p}{T\theta(\theta - p)} [e^{(\theta-p)T} - e^{-pT}] + \frac{C\bar{N}p(1 - \gamma)}{(\theta - p)T} [e^{(\theta-p)T} - 1] - \bar{N} \frac{C}{T} \left(\frac{I}{(\theta - p)} - \gamma \right) [1 - e^{-pT}] \tag{2}$$

Using the preceding formulas, the constant values for the process input variables are determined (Table 2).

Table 2. Constant variables.

Variables	Description	Value
A	Order costs	160.15
C	Product costs	56.40
T	Cycle time	35
Γ	Salvage percentage of deteriorated units	47%

However, for the following variables, four scenarios were proposed for later development (Tables 3, 4, 5 and 6).

Table 3. Variable: Potential Market Size.

Potential Market Size				
1	Ñ1	160	Ñ3	180
	Ñ2	170	Ñ4	190
2	Ñ1	170	Ñ3	190
	Ñ2	180	Ñ4	200
3	Ñ1	180	Ñ3	200
	Ñ2	190	Ñ4	210
4	Ñ1	190	Ñ5	210
	Ñ2	200	Ñ6	220

Table 4. Variable: Coefficient of Innovation.

Coefficient of Innovation				
1	p1	0.005	p3	0.007
	p2	0.006	p4	0.008
2	p1	0.006	p3	0.008
	p2	0.007	p4	0.009
3	p1	0.007	p3	0.009
	p2	0.008	p4	0.01
4	p1	0.008	p3	0.01
	p2	0.009	p4	0.011

Table 5. Variable: Inventory Maintenance Percentage.

Inventory Maintenance Percentage				
1	I1	0.15	I3	0.17
	I2	0.16	I4	0.18
2	I1	0.16	I3	0.18
	I2	0.17	I4	0.19
3	I1	0.17	I3	0.19
	I2	0.18	I4	0.2
4	I1	0.18	I3	0.2
	I2	0.19	I4	0.21

Table 6. Variable: Coefficient of Deteriorated Products.

Coefficient of Deteriorated Products				
1	θ1	0.05	θ3	0.07
	θ2	0.06	θ4	0.08

Calculation of Fuzzy Values. Fuzzy calculations are performed per unit of time based on trapezoidal fuzzy numbers (Fig. 2).

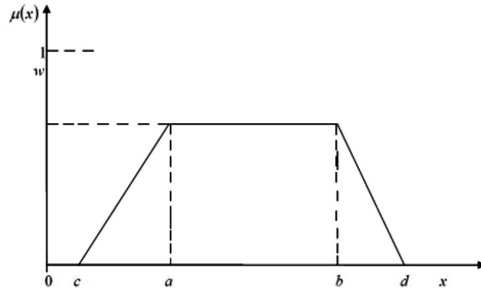


Fig. 2. Trapezoidal fuzzy numbers

Based on this, operations are reformulated obtaining new mathematical operations such as the one presented below:

$$\begin{aligned}
 K_i(T) = & \frac{A}{T} + \frac{IC\tilde{N}p}{T(\theta - p)} \left[e^{(\theta-p)T} - 1 \right] \\
 & - \frac{IC\tilde{N}p}{T\theta(\theta - p)} \left[e^{(\theta-p)T} - e^{-pT} \right] - \tilde{N} \frac{C}{T} \left(\frac{I}{(\theta - p)} \right) [1 - e^{-pT}] \quad (3) \\
 & - \frac{\gamma C\tilde{N}p}{T(\theta - p)} \left[e^{(\theta-p)T} - 1 \right] + \tilde{N} \frac{C\gamma}{T} [1 - e^{-pT}]
 \end{aligned}$$

Value Defuzzification. Finally, to calculate total costs, the order quantity, and the number of deteriorated units, the defuzzification mean rule method is used (Fig. 3).

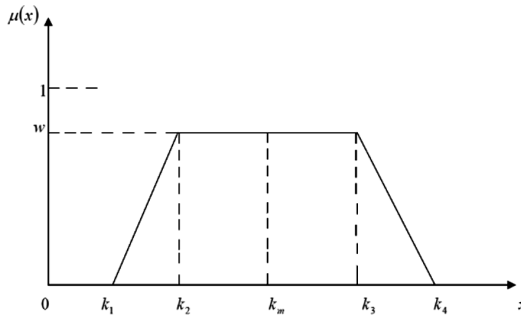


Fig. 3. Deffuzification mean rule

Based on this method, as presented in [1], the following formulations are obtained:

- Order Quantity

$$Q_m(T) = \frac{\tilde{N}1p1}{4(\theta4 - p1)} \left[e^{(\theta1-p1)T} - 1 \right] + \frac{\tilde{N}2p2}{4(\theta3 - p2)} \left[e^{(\theta2-p2)T} - 1 \right] + \frac{\tilde{N}3p3}{4(\theta2 - p3)} \left[e^{(\theta3-p3)T} - 1 \right] + \frac{\tilde{N}4p4}{4(\theta1 - p4)} \left[e^{(\theta4-p4)T} - 1 \right] \tag{4}$$

- Total Costs

$$K_i(T) = \frac{C\tilde{N}p}{4T(\theta - p)} \left[e^{(\theta-p)T} - 1 \right] - \frac{IC\tilde{N}p}{4T\theta(\theta - p)} \left[e^{(\theta-p)T} - e^{-pT} \right] - \tilde{N} \frac{C}{4T} \left(\frac{I}{(\theta - p)} \right) \left[1 - e^{-pT} \right] - \frac{\gamma C\tilde{N}p}{4T(\theta - p)} \left[e^{(\theta-p)T} - 1 \right] + \tilde{N} \frac{C\gamma}{4T} \left[1 - e^{-pT} \right] \tag{5}$$

3.2 Worker Learning and Knowledge Management

Worker learning is a variable that must be considered in the application of diverse techniques, tools, and working methodologies regarding the preparation of orders and their picking and packaging activities.

Historically, order picking has been deemed as the most expensive activity in storage operations. In 1999, in the United Kingdom, it was estimated that it constituted over 60% of these costs [13]. However, this value has not recorded significant changes since. For example, in 2007, it was estimated that it constituted approximately 55% of the warehouse operations expenses [11].

As shown in Fig. 4, knowledge management is a variable to be considered in the management of supply chains because its main results are related to obtaining value for customers through products or services with the required specifications. Additionally, it also increases productivity in the operations flow processes and in the working climate through which an organization is governed [18].

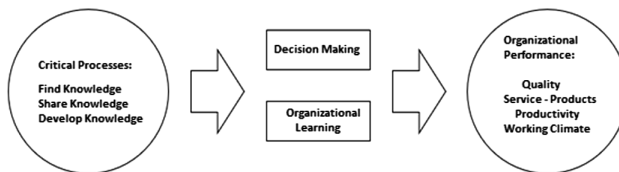


Fig. 4. Knowledge management processes

Regarding knowledge management, the following steps are required for successful application.

- Strategic evaluation
- Guidance, analysis, and development
- Implementation
- Assessment and control

TRAINING SESSION EVALUATION

Please provide your opinion on the Training Session Received

Date: _____ → Training Date

Name of Training Program: _____ → Training Session Name

Duration: _____ → How long the Training Session lasted

The Session	Yes	No	
Do you know why you are receiving this Training Session?	<input type="checkbox"/>	<input type="checkbox"/>	<ul style="list-style-type: none"> → Describe how clear Knowledge and Objectives were → Describe if training times were appropriate
Were the Training Objectives clear?	<input type="checkbox"/>	<input type="checkbox"/>	
Was the Training length appropriate?	<input type="checkbox"/>	<input type="checkbox"/>	
Were all the Topics covered properly?	<input type="checkbox"/>	<input type="checkbox"/>	
Will this Training Session help you in your work?	<input type="checkbox"/>	<input type="checkbox"/>	

- Describe whether the Training reasons were disclosed
- Describe whether the Training Session's length was appropriate
- Describe whether the Training Session helped facilitate Operations

Fig. 5. Pre-knowledge management assessments

- Initially, the company must undergo an evaluation process consisting of identifying the current knowledge possessed by the company since it is acquired explicitly by prior understanding of organizational processes. The knowledge generated through the development of these processes may be classified as tacit (Fig. 5).
- Then, the conceptual knowledge management data is structured as per the training required to implement the techniques being developed.
- Regarding knowledge management implementation, the starting point is the training sessions outlined in the previous item.
- As part of the assessment and control step, the employees of the organization are required to undergo a series of evaluations that support the knowledge acquired in the training sessions (Fig. 6).

LEARNING EVALUATION

Please provide your opinion on the Training Sessions received

Date: _____

Name of Training Program: _____

Duration: _____

LEARNING	Yes	No
Did you know how to perform these activities before attending Training?	<input type="checkbox"/>	<input type="checkbox"/>
Do you think your Learning Satisfaction level is high?	<input type="checkbox"/>	<input type="checkbox"/>
Will the Training Program help facilitate your working day processes?	<input type="checkbox"/>	<input type="checkbox"/>
Will you apply what you have learned in your activities?	<input type="checkbox"/>	<input type="checkbox"/>
Should there be more Training Sessions to reinforce what you have learned?	<input type="checkbox"/>	<input type="checkbox"/>

Describe how long the Training Session lasted ←

Describe whether you had previous knowledge on Operations before the Training Session ←

Describe if, in your opinion, the Training Session will help facilitate processes ←

Describe if more Training Sessions should be scheduled to further expand the topics covered ←

Fig. 6. Post-knowledge management assessments

4 Validation

The company under study is Telecom ABC, a telecommunications vendor in Peru with variable product life cycles and high levels of global competition.

The designed models will be validated using different tools, techniques, or methodologies. For this project, results will be obtained by applying simulations using mathematical formulations and different software programs. Likewise, the information of the first semester of the year was used.

4.1 Fuzzy EOQ

Validation was performed for the main product determined through the ABC multi-criteria classification. Optimal values were obtained through fuzzification and defuzzification calculations, focusing on the total order cost and the quantities required according to current market demands (Table 7).

Table 7. Comparison of Results by Scenario.

Scenario	Quantity	Total costs
1	Q 183.97	K (T) 18066.95
2	Q 205.76	K (T) 18091.52
3	Q 226.76	K (T) 18116.09
4	Q 247.00	K (T) 18140.67

Analysis of Metrics. In the development of the components provisioned in this study, several results were generated from the main indicators for each component. These

results were then compared against the current values representing the actual situation of the organization (Table 8).

Table 8. Comparison of Results by Scenario.

Components	Indicator	Current	Proposal	Difference
I	Inventory rotation	4.02	3.87	0.15%
	% Obsolete products	7%	5%	2%
II	% Products damaged	11%	7%	4%
	Avg. order travel distance	58.3 m	36.7 m	21.6 m
III	Inventory accuracy	89%	95%	6%
	Difference	5%	3%	2%
General	Order fulfillment	89%	91%	2%

5 Conclusions

The purpose of this study is to expand current supply-chain management knowledge in the telecommunications sector. This sector is characterized by several factors such as the dynamism of their behavior in terms of requirements, i.e., companies in this area are likely to improve their actions to provide faster responses. Therefore, agile management emerges as a philosophy focusing on improving response to customer queries and reducing its uncertainties. The case presented demonstrates how operating costs can be reduced. The proposal designed as the solution, considering best-case scenarios, was able to reduce approximately 85% of the previously identified problem, which translated into savings of 75% in additional penalty costs considering the investment required for the development of the project.

References

1. Kumar, A., Chanda, U.: Economic order quantity model for new product under fuzzy environment where demand follows innovation diffusion process with salvage value. *Int. J. Procure. Manag.* **9**, 290–309 (2016)
2. Gaudenzi, B., Christopher, M.: Achieving supply chain ‘Leagility’ through a project management orientation. *Int. J. Logist. Res. Appl.* **19**, 3–18 (2016)
3. Lam, P.L., Shiu, A.: Economic growth, telecommunications development and productivity growth of the telecommunications sector: evidence around the world. *Telecomm. Policy.* **34**, 185–199 (2010)
4. Rajasekar, J., Al Raee, M.: An analysis of the telecommunication industry in the sultanate of Oman using Michael porter’s competitive strategy model. *Compet. Rev.* **23**, 234–259 (2013)
5. Lim, M.K., Tseng, M.L., Tan, K.H., Bui, T.D.: Knowledge management in sustainable supply chain management: improving performance through an interpretive structural modelling approach. *J. Clean. Prod.* **162**, 806–816 (2017)

6. Colomo-Palacios, R., Fernandes, E., Soto-Acosta, P., Larrucea, X.: A case analysis of enabling continuous software deployment through knowledge management. *Int. J. Inf. Manage.* **40**, 186–189 (2018)
7. Zahran, S.K., Jaber, M.Y., Zaroni, S.: Comparing different coordination scenarios in a three-level supply chain system. *Int. J. Prod. Res.* **55**, 4068–4088 (2017)
8. Andreou, P.C., Louca, C., Panayides, P.M.: The impact of vertical integration on inventory turnover and operating performance. *Int. J. Logist. Res. Appl.* **19**, 218–238 (2016)
9. Lagodimos, A.G., Skouri, K., Christou, I.T., Chountalas, P.T.: The discrete-time EOQ model: solution and implications. *Eur. J. Oper. Res.* **266**, 112–121 (2018)
10. Roodbergen, K.J., Vis, I.F., Taylor Jr., G.D.: Simultaneous determination of warehouse layout and control policies. *Int. J. Prod. Res.* **53**, 3306–3326 (2015)
11. De Koster, R., Le-Duc, T., Roodbergen, K.J.: Design and control of warehouse order picking: a literature review. *Eur. J. Oper. Res.* **182**, 481–501 (2007)
12. Yan, B., Yan, C., Long, F., Tan, X.C.: Multi-objective optimization of electronic product goods location assignment in stereoscopic warehouse based on adaptive genetic algorithm. *J. Intell. Manuf.* **29**, 1273–1285 (2018)
13. van den Berg, J.P., Zijm, W.H.: Models for warehouse management: classification and examples. *Int. J. Prod. Econ.* **59**, 519–528 (1999)
14. Wang, Y.C.: Evaluating flexibility on order quantity and delivery lead time for a supply chain system. *Int. J. Syst. Sci.* **39**, 1193–1202 (2008)
15. Yu, K., Cadeaux, J., Song, H.: Flexibility and quality in logistics and relationships. *Ind. Mark. Manag.* **62**, 211–225 (2017)
16. Cai, S., Wang, Y., Miao, Z.: Exploring key antecedents of supply chain agility: an empirical study. In: 2012 9th International Conference on Service Systems and Service Management—Proceedings of ICSSSM 2012, pp. 835–839 (2012)
17. Ma, M., Li, X.: The design and countermeasures of agile supply chain management mode research. In: 2009 International Conference on Information Management, Innovation Management and Industrial Engineering, ICIII 2009, pp. 141–143 (2009)
18. Cepeda-Carrion, I., Martelo-Landroguez, S., Leal-Rodríguez, A.L., Leal-Millán, A.: Critical processes of knowledge management: an approach toward the creation of customer value. *Eur. Res. Manag. Bus. Econ.* **23**, 1–7 (2017)



A Study on Concepts Development of “Locavore” for Restaurant Managers in Taiwan

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Abstract. The issues of the food safety, the increasing globalization of food production, and the perceived food risks have raised consumer’s doubt about the industrial food system and changed consumer’s purchasing habits. That is resulting in the emerging food system that food produced and consumed locally. The short supply food chain and transparent procedure could enhance food quality. The basis of the local food system is the face-to-face relationship between producers and consumers. However, there are many different concepts in the literature that explain the local food system. The purpose of this study is the concept of local food systems and ‘Local Consumption of Locally Produced, LCLP’ from the restaurant manager’s perspective. This study will conduct a review of literature related to the local food system and the ‘Locavore’, and through personal interviewing, focus groups, to understand ‘LCLP’, as well as conceptualize comprise production, consumption, and management dimensions. Findings provide the local food system and the specific approach by the ‘Locavore’ in restaurant operations strategy as a future reference for the management plan.

Keywords: Local consumption of locally produced · LCLP · Locavore · Local food system · Restaurant management

1 Introduction

Since 1990, rural land use planning has moved from productivism to post-productivism in Taiwan. Through national agricultural subsidies, price protection policies emphasize that maximizes the production of goods. The Post-productionism means a shift in the

way agriculture produced. The rural functions are not only use for production, and agricultural land is not only used for agricultural production but also includes functions such as environmental and cultural. After 2000, the new system of sustainable agriculture in production began to pay attention to the regional food supply chain, and the integration of agriculture and other rural activities, the agricultural production of high-quality food and the consumption of rural areas [1, 2].

In recent years, food safety issues have caused public distrust of industrial food systems. Shortening the food supply chain, which is long and opaque in the industry and improving the quality of food are more valued by the public. The improvements of people’s lives and their emphasis on food safety have led to a focus on agricultural production. The topic “Local Consumption of Locally Produced, LCLP” began to be explained.

Currently, there is no clear definition for ‘LCLP’. “Local Consumption of Locally Produced” literally explains that locally produced agricultural products are consumed directly by local people, farms, and restaurants. There are also many different concepts in the literature that explain the local food system. The purpose of this study is the concept of local food systems and “LCLP” from the restaurant manager’s perspective. This study will conduct a review of literature related to the local food system and the ‘LCLP’, and through personal interviewing, focus groups, to understand ‘LCLP’, as well as conceptualize comprise production, consumption, and management dimensions. Therefore, understanding the restaurant’s management of the concept of “LCLP”, this is the background and motivation of the study.

Purpose of this study is:

- (1) Explore the connotation and definition of LCLP.
- (2) Clearly define “LCLP”.
- (3) Through the qualitative research, we identify the connotation of restaurant management on the Local Consumption of Locally Produced, and clearly define the concept of “LCLP”.

2 Literature Review

This research introduces the literature related to the Local Consumption of Locally Produced, LCLP, Locavore and the restaurant management perspective. The construction of the Local Consumption of Locally Produced and summarizes it in three areas: production, consumption, and operations were also been discussed.

In 1932, Japan enacted the first nutrition lunch regulation in school, and in 1954, it was passed the school nutrition lunch bill, using the school to purchase local agricultural products as a nutritious lunch material. In 2005, they listed “food education” and “Local Consumption of Locally Produced” as supporting projects to increase food self-sufficiency. They hope to promote the “easy-to-understand and food education, local consumption of Locally Produced, expand the consumption of domestically produced agricultural products, and consumer confidence” in Japan. In recent years, they have combined green tourism, using local agricultural experience activities to

integrate local production, and combining education to achieve cultural heritage and enhance agricultural value [3–5].

The United States has set a bill to actively promote Local Consumption of Locally Produced, in 1976 [6]. In 2005, the Vancouver of Canada promoted the 100 Mile Diet diet, which believes that the thought the farther away from the food, the more energy it consumes. Therefore, they encourage everyone to eat local agricultural products and reduce carbon dioxide to support the development of local agricultural economy. In June, the concept of ‘locavore’ was presented at the World Environmental Day conference in San Francisco, with a one-hundred-scale diet in San Francisco. The rise of the Local-Food campaign in the United States has led to a preference for local production, the government has promoted positives, and has also changed consumer buying behavior [7].

In summary, the driver of Local consumption local production is divided into environmental factors and consumption factors. Therefore, there are different interpretations. Local Consumption of Locally Produced, LCLP means that the distance between food consumption and production is shorter than the previous local food system. The “locavore,” which was NOAD’s 2007 word of the year, as a local resident who tries to eat only food grown or produced within a 100-mile radius. Alternatively, it uses other concepts to illustrate this concept, such as local food (Local food), local food system, (re)localization ((re)localization), etc.

Restaurant management in the use of food system indicators, [8, 9] build green restaurant management indicators from the perspective of a green food supply chain and are divided into

- (1) Upstream: Food;
- (2) Midstream: Environment and equipment;
- (3) Downstream: Management and Social Responsibility.

The management of this supply chain is divided into 9 sub-topics and 76 performance indicators covering the environmental actions that need to be taken care of upstream, middle, and downstream of the supply chain. This study will conduct a review of literature related to the local food system and the ‘Locavore’, as well as conceptualize comprise production, consumption, and management dimensions. Its connotation is shown in Table 1.

Table 1. LCLP’s concept and connotation

Concept	Item
Production	Direct marketing Shorten the distance Reduce carbon footprint Innovation
Consumption	Alternative agro-food networks Internet Food agricultural education
Operations	Agricultural tourism Agricultural product quality Certification

This study involves the development model of its indicator structure and adopts food supply chain management to develop the composition and connotation of LCLP. Establish an assessment indicator that complies with Taiwan local production local consumption, LCLP concept and connotation in the restaurant.

3 Research Methods

The research literature analyses the local food supply chain that local producers and local consumers consume in Taiwan. Through personal interviews and panel discussions, they understand the content of various stakeholders who locally consume local production value activities. Through in-depth interviews, focus groups and content analysis method, we will production; consumption and management perspective discuss various aspects of the LCLP.

3.1 Research Object

This study purposive sampling to find specific subjects with relevant knowledge and insights on this research topic [10]. Sampling objects are Stakeholders of restaurant operations and Local Consumption of Locally Produced. The Stakeholders cover Producer, Supplier, Operator, Consumer, and Certified expert.

3.2 Focus Groups

This study has 35 subjects. In the 5 session’s focus group discuss, each discuss is a different group, and the members are 5–8 people. Each session focus group time is about 1.5–2.5 h. The content of the session was recorded throughout the entire process, and the contents of the voice were converted into text records by words.

3.3 Personal Interviewing

In order to ensure interviewees provided the information that the research group needed and to reduce invalid answers, an interview outline was prepared before visiting. We also established friendly relations to improve the spirit of the interview. An explanation of the research was provided prior to the interview. The interviews were recorded in order to sum up the visit and discuss the results after the interview. The interviewees of this study are restaurant operations or managers, and the interview time is approximately 1 h per person.

3.4 Data Analysis

This study used individual interviews and focus group as data collection methods. The Objective To achieve data triangulation of data to improve the validity and reliability of qualitative analysis results [11]. Data collection time is from July 2016 to March 2018.

This study transforms the focus groups and in-depth interview results in verbatim texts and treats the important concepts obtained as an analysis unit. It was performed

using content analysis. According to the research purpose, the researchers classify similar units into a meaningful and interpretable category. This study will examine the validity of the data through triangulation [12]. Finally, this study fully discusses the categorization and naming, until these concepts and projects can correctly reflect the concept of Local Consumption of Locally Produced by the restaurant manager.

4 Results and Discussion

Based on personal interviews, focus groups and reference literature survey results, sorting out the restaurant manager’s local Local Consumption of Locally Produced concept in the restaurant’s industry value chain each activity (Fig. 1), and in support activities for the Food source, Business needs Marketing appeal. Its facets are restaurant food source, restaurant business needs and restaurant marketing appeals, 8 related constructs.

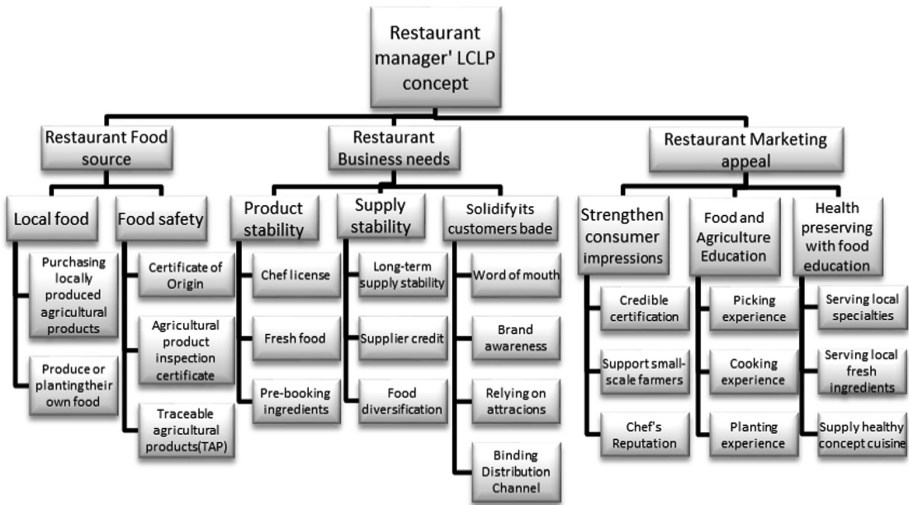


Fig. 1. The tree of concepts development of “Locavore” for restaurant managers.

4.1 Restaurant Food Source

In the industrial chain operated by the restaurant, the source of foodstuffs is upstream of the industrial chain. The sources of foodstuffs in the upper reaches are very important. Whether the foods are local ingredients or not, and the food sources have considerable protection.

Food sources include local food and food security at the local level. Local food is the most often talked about as early as 1986, it has been pointed out Locke Retz available to consumers with high quality and reasonably priced food in the food through the system. This study found that restaurant managers pay significant attention

to the choice of ingredients in the local food: purchase or purchase of locally produced agricultural products, some restaurants produce their own products, food comes from themselves.

A food safety crisis occurred in Europe and the United States in the 1990s, which made consumers pay attention to food safety [13]. Consumers not only need to improve the hygiene and health standards of agricultural products and foods, but also the certification and certification of the source and manufacturing methods of products, and also pay more attention to the production of products by special production methods [14].

Analysis of the results of the study, the certificate of origin, the inspection of agricultural products and the availability of production history for restaurant management can provide important conditions for the consumer LCLP concept.ts; and whether the source is fairly guaranteed.

4.2 Restaurant Business Needs

Management must consider many factors: including product stability, such as food costs, food taste, quality; equipment can maintain normal; availability is stable, and the source market can be normal.

The product can be stabilized through a chef with a chef’s license, for the stability of the dishes, and chefs could continue to receive relevant training. The level of taste of the dishes is certain. Operating costs need to be aware of the freshness and safety of food sources, maintained by inventory control and food preservation management. In addition, restaurant management requires a variety of food materials. Therefore, in order to ensure the stability of the products, the operators must pre-book the food materials, and cooperate with the farms and nearby farmers.

The supply of the restaurant’s suppliers (foodstuffs) is sufficient and stable, and the restaurant manager will choose the suppliers that will cooperate for a long period of time. In addition, that also sign contracts with farms near the restaurant to obtain long-term cooperation, and we have special production and distribution channels. The restaurant forms a network with neighboring farms to achieve long-term supply of pipelines. As a result, the stability of the food source requires long-term cooperation with suppliers of stable suppliers and credit.

Stable source is an important condition for ensuring the operation of the restaurant. A normal source of customers can have a normal profit, and a normal profit can be used to hire the relevant manpower. Including: word of mouth, brand awareness, relying on sightseeing spots and combined access. The cooperation mode between the restaurant and the source channel, such as combining with the travel agency to package the restaurant’s special products, combining the travel experience or surrounding attractions and itineraries; it is a way to stabilize the consumers’ source.

4.3 Restaurant Marketing Appeal

The purpose of the downstream is to enable consumers to recognize and convince the product and promote their purchase and consumption. For the recognition of food and

business operators. This section is how to strengthen the consumer's impression of the local consumption of local food; and how to promote relevant education.

The marketing methods of the restaurant include; strengthening the consumer's impression of local Local Consumption of Locally Produced and promoting the education of local Local Consumption of Locally Produced.

Promoting a credible certification system through government departments and credible non-profit organizations can reinforce the impression of consumers. The study pointed out that through education operators and consumers, there is marketing support for the restaurant to promote the concept of local Local Consumption of Locally Produced.

In addition, there is a new way of publicity on marketing; public relations. The work of public relations helps to establish the image of the restaurant in the public; such as the choice of local farmers to produce or help small-scale agriculture can be imaged.

The well-known chefs or operators in LCLP's restaurants are also one of the factors that strengthen restaurant marketing.

Japanese food and agriculture education are based on the "environment" as a means to integrate into the daily life of school children so that children can learn to master food materials and develop healthy eating habits. The food and agriculture education concept of the real estate restaurant manager includes three parts: the picking experience, the cooking experience, and the planting experience.

Strengthen the memory of local Consumption of Locally Produced and increase the fun by the process of the consumer's personal involvement in the experience.

Health preserving with food means that the food in our life has a great relationship. This study found that the local consumption of Locally Produced through health preserving with food education, including providing local specialties and supplies, Local fresh food and that supply the concept of health.

5 Conclusion and Suggestion

The main purpose of this study is to present the Concepts Development of "LCLP" for Restaurant Managers in Taiwan.

5.1 Conclusion: The Connotation and Definition of Local Consumption of Locally Produced for Restaurant Managers

The concepts of production and local consumption have been promoted in other countries for many years. In recent years, Taiwan has begun to pay attention to it.

The content analysis carried out by the researchers obtained three dimensions in the operator's value chain and the downstream, covering three major categories; there are eight local production and local consumption connotations.

The results of the study reveal the production of local raw materials; the stability of supply and sources of demand for companies; and consumer demand for marketing methods. This strengthens the consumer's impression of local production and local consumption and the recognition of food education.

The research results will provide an important theoretical basis for understanding the practical application of the catering industry and promoting local production and local consumption.

5.2 Suggestion

According to the results, in the future, when operators promote the concepts of local production and local consumption, they can start with education policies in the supply chain and provide more publicity networks.

- (1) The industry supply chain of upstream is producer cognition: food sources, food source certification and policy incentives
- (2) The industry supply chain of middle-stream is the restaurant cognition: the restaurant has Local Consumption of Locally Produced, LCLP certification.
- (3) The industry supply chain of downstream is consumer perception: the way of restaurant marketing

The results are expected to extend the scope of Local Consumption of research Locally Produced, rich LCLP and Locavore theory.

References

1. Wilson, G.: From productivism to post-productivism and back again? Exploring the (un) changed natural and mental landscapes of European agriculture. *Trans. Inst. Br. Geogr.* **26**, 77–102 (2001)
2. Holmes, J.: Diversity and change in Australia’s rangelands: a post-productivist transition with a difference? *Trans. Inst. Br. Geogr.* **27**, 362–384 (2002)
3. Hu, Z.Y.: Japanese Farmers Market and Roadside Station. Council of Agriculture, Executive Yuan (2004)
4. Yen, C.S., Zeng, Y.L., Zhuang H.H.: Discussion on promoting urban-rural exchange and revitalizing rural development with rural festival activities. *Agric. Ext. Anthol.* **55**, 13–30 (2011)
5. Chen, M.F.: A geographical network link between producers, consumers and tourists from the Japanese agribusiness market. *Agric. Ext. Anthol.* **57**, 344–399 (2012)
6. Low, A.S., Vogel, S.: Direct and intermediated marketing of local foods in the United States. *Economic Research 3. Report. ERR-128. United States Department of Agriculture* (2011)
7. Chang, W.C. (ed.): *Handbook of Food and Agriculture Education*. Department of Economic Development, Taipei City Government, Taipei (2013)
8. Wang, Y.-F., Chen, S.-P.: A study on construction of green restaurant certification standards in Taiwan. In: Paper Presented at the Conference of the 9th APacCHRIE, Hong Kong SAR, China (2011)
9. Wang, Y.-F., Chen, S.-P., Lee, Y.-C., Tsai, C.-T.: Developing green management standards for restaurants: an application of green supply chain management. *Int. J. Hosp. Manag.* **34**, 263–273 (2013)
10. Lincoln, Y.S., Guba, E.G.: *Naturalistic Inquiry*. Sage, Newbury Park (1985)
11. Mhyre, J.M.: Assessing quality with qualitative research. *Can. J. Anesth.* **57**(5), 402–407 (2010)
12. Thurmond, V.A.: The point of triangulation. *J. Nurs. Scholarsh.* **21**, 253–258 (2001)

13. Ilbery, B., Kneafsey, M.: Product and place: promoting quality products and services in the lagging regions of the European Union. *Eur. Urban Reg. Stud.* **5**, 329–341 (1998)
14. Wang, J.H., Zhou, M.X.: EU agricultural origin of the food names, geographical indications and traditional specialties protection system. *Agric. Policy Rev.* **172**, 79–86 (2006)

**Business Management and Society:
Employment Views**



Benefits of Employees Social Network Sites Profiles for Job Applicants

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Abstract. This paper investigates the benefits of social network site (SNS) profiles of employees for candidates. The research is interested in identifying the value of information contained within SNS profiles to applicants. The knowledge that potential candidates use SNS profiles during the employment seeking process is important for companies to know how to use such profiles successfully. The digitalization and change of the labor market are new circumstances for companies. That needs innovative and new solutions to support the employment seeking process. The research used an online survey for target group with 362 respondents per analyzed item. This research provides a deeper insight into the operations of SNSs profiles and provides explanations as to how and why individuals use SNSs.

Keywords: Social network · Employment · Human resources · Recruiting

1 Introduction

The labor market is changing to an applicant market and that is an actual topic for companies. There are more open positions than available applicants. Companies need new channels to provide information to potential applicants. Digitalization has provided a new channel in SNSs. SNSs especially the profile from the employees with their information are a risk and opportunity for companies [1]. The research investigates the importance and usefulness of information within SNS profiles for applicants and if they use the profiles to collect information. SNSs provide the opportunity to identify information about individuals and their skills [2] which has great importance in e – recruitment process [3]. The use of SNSs creates an economical advantage for the applicants and companies. They can use the information and advantages of SNSs to be successful [4]. The paper investigates the operations and use of SNSs with the social capital theory. The theory explains the relationships between individuals and advantages of social networks. The main advantage is the beneficial information and resources [5]. The opportunity to maintain relationships and to use the relationships for the advantage of SNS's members, is important for the operation of social networks. There is some research about the use of SNS profiles for the employment seeking process, the use of companies to identify candidates for example [6]. The research

regarding potential applicants that use SNS profiles for the employment seeking process; that potential candidates investigate the profile of employees, is contrary to the actual research that is investigating the behavior of companies. That is a new interesting research field and perspective to which there has been paid attention of academic researchers world-wide [7].

The empirical research has been done with an online survey: respondents selected to be included in the sample and were invited personally to participate in the survey, if the respondents did not complete the survey within two weeks, a reminder was sent, and again at four weeks if still not completed. The survey data were analyzed with most often used indicators of descriptive statistics – indicators of central tendency or location (arithmetic mean, median, mode), indicators of variability (range, and standard deviation), for data analysis there were used also Spearman correlation coefficient for testing statistical hypothesis. The paper presents the statistical relevant results to test the assumptions and statements regarding the importance of information of SNS profiles for the employment seeking process. The research investigates the differences between getting information from private and business SNSs. The privacy perception between the private and business SNS is different [8] and influences the employment seeking process. In addition, under consideration is the influence of “duration of membership in years in SNSs”, “number of contacts” and “use in minutes per day”. Those are factors influencing the use of SNSs and are an investment in SNSs.

The research investigates the statement that SNS profiles of employees have an influence on the employment seeking process for applicants. That applicants use the information within SNS profiles for their benefit is another statement to be analyzed. The assumption is that business SNSs are more suitable than private SNSs.

The results provide recommendations on how companies can use their employees SNS profiles and present the relevance of SNS profiles for the employment seeking process: that companies have an advantage with the use of the SNS profiles. The paper provides the information on what kind of SNSs are more convenient, if private or business SNSs are more beneficial [9]. Some companies invest their resources on the most successful kind in their efforts to inform and motivate potential candidates.

2 The Importance of Social Network Sites Profiles for the Employment Seeking Process

Companies need well-educated employees with excellent skills to be successful. At the moment it is difficult to find suitable employees and potential candidates have many opportunities to collect information about potential employers from one side and possible employees from the other side, and fast development of information technologies creates opportunities and needs in use of social networks also for the employment seeking process and job offers. One place to find information are SNSs [10], the use of SNSs is increasing and gaining importance. Companies and individuals can obtain and maintain their reputation. They can use social networks for their advantage to be successful [11]. The risk for the company is that the presented information is disadvantageous, or employees present themselves in a negative shape. That is the danger and the significance of SNS profiles for the employment seeking

process; companies need to be investigated to provide a deeper insight in the operations and functionalities of SNSs. That support companies to use the SNSs profiles of their employees for their advantage e.g. to provide additional information to potential candidates and to motivate suitable and interesting candidates to send an application. The literature review presented SNSs as a useful and beneficial tool for the employment seeking process [12]. Companies use SNSs to identify candidates and individuals collect information about companies. They invest their time and knowledge in the social network and the reason to join networks is to have access to resources and information. The exchange is important for the network that individuals can share the resources and information [13]. That is the social capital of the network. The operations and behavior of individuals in social networks is explained with social capital theory. The theory provides explanations for the use of SNSs and provides reasons that individuals join social networks [14]. The research theoretical background is the social capital theory and recent developments on use of virtual networks for the employment seeking process.

Social networks are a good place to get access to resources and information. People can use their contacts to receive beneficial information. The information and resources are only available for network members exclusively and provide additional valuable information. Supporting individuals to reach a decision and to cooperate with other network members to get a deeper understanding about an issue, for example. SNSs are platforms in the internet which provide the opportunity to create ties and to maintain relationships [15]. The difference between real networks and SNSs is the anonymity of the members; it may be that they do not know each other in person. Further is it possible to “improve” information on SNS profiles which cannot be approved. The advantage is the size of the network, the amount of SNS members. The technology supports a growing and developing network because the software enables the individuals to control and organize their network quickly and easily, world-wide. SNSs provide the opportunity to create profiles and to present information about the individual with that profile. This information enables other SNS members to search for network members and to get in touch with network members who have needed or desired resources or information [16]. The paper concentrates on the profiles from employees of companies for which other SNS members apply. The potential candidate can use those profiles to their advantage.

Networks have different tasks and opportunities for their members. The SNSs are online platforms which enable individuals to create and maintain relationships. In addition, it is important to investigate individuals and their skills for example. That means people use SNSs to collect information and to have an advantage. There are different networks available in the internet. This paper evaluates private and business SNSs [17]. Both kind of networks have their purpose and provide different information about individuals. In addition is the use and behavior in various SNSs is different. Private SNSs, for example, are mainly used for private reasons e.g. to organize leisure time. There are the opportunities to share pictures from holidays or parties, for example. Those networks are like *Facebook*. The other kind of networks are business networks. Those networks have the task of organizing the relationships of business individuals. The content of these web pages is business relevant and the profiles present skills and career steps of the member. The exchange in the business SNSs are mainly

about business, to present products, services and solutions. A typical business SNS is *LinkedIn*. The business and private SNSs are different e.g. their purpose is contrary. Individuals behave on these pages differently [18]. The pages provide different tools: the tools are customized e.g. for the needs of the business SNS user and to fulfil the desire of the member. Often companies are using SNSs to identify candidates and to collect information about potential candidates - they analyze their profile. If the profile is of interest it is possible to contact the individual and to ask if the person is interested to join a new employer. Recruiting needs this new channel to identify suitable well educated and experienced candidates. At the moment, Germany is a candidate market. That means there are more open positions than candidates. This situation is very difficult for companies because they need suitable employee to be successful, that they have the best employees or resources to be successful. SNSs can support companies to present themselves to potential candidates e.g. with posts in groups about their success or products. That is a passive opportunity. The active opportunity is the direct search, to search for the candidates and contact them. The creation and design of SNS profiles of employees is a passive way. The employee provides information to a large audience via the SNS profile and presents the company to other SNS members.

3 Operation of Networks for the Employment Seeking Process

There is much research to evaluate how individuals use SNSs for the employment seeking process. Especially that companies use SNSs profiles to evaluate candidates. They use the SNS profiles to identify suitable candidates for their open positions [19]. This research is contrary and investigates the use of SNS profiles of the recruiter by employment seeking individuals to collect more information about the potential employer. The assumption is that the employment seeking individuals visit the profiles of the recruiter to have an advantage. It is important for companies to know if potential candidates use SNS profiles to decide to apply or to collect information about the company. This knowledge about the use of SNS profiles by employment seeking individuals is important information for companies and recruiters to prepare their profiles. That they can provide the expected and needed information on their profile, that they can improve their profile to have a positive charisma for the employment seeking individuals [20]. The research question is how companies can use the SNSs profiles of their employees to their benefit.

The SNSs provide the opportunity to collect information and to benefit from that information. That leads to the statement that individuals use the opportunity to collect information for the employment seeking process on SNS profiles of recruiters to have an advantage [21]. SNS profiles provide much information relevant for potential candidates. The research question is "Why would you visit SNS profiles of employees if you apply with the company?". That question is asked to the participants of the survey separately for business and private SNSs as those two SNSs are different.

The SNS profiles include information about the career path in a company and duration of employment with a company. Candidates are interested to know how long people are working for a company because that is an indication about the culture and

atmosphere in the company. This information is important to know if people are satisfied and stay with a company. That is the reason for the answer opportunity “to investigate the duration of employment of the employees” [22]. People are interested to develop their skills and career. They are keen to reach objectives and their motivation is to get exciting and responsible positions in a company. That leads to the response options for the participant “to investigate possible career opportunities in the company”. Potential candidates are interested to collect real information and to collect additional information about potential employers. The decision to apply is important for them and they are keen to find the best suitable company for them. The secrets of the company are very interesting, and candidates have the desire to get a full picture about their prospective employer. The response opportunity “because there is realistic information about the company (compared with official sources)” is to investigate if SNSs profile content offers further information of interest for candidates [23]. Another opportunity to use SNS profiles is when preparing the application for the company. The required qualifications are important to know for applicants. That the potential applicant can decide if they match the requirements and if the qualifications motivate the candidate to apply for a position. For example, the use of a new innovative programmer language is very motivating for IT consultants to apply for a position. That information is of interest to find an exciting position and to learn more about the tasks and opportunities in a company. That is a pull factor for the recruiting process to increase the desire of individuals to apply. The answer possibility to investigate that is “to investigate the qualifications which are important there” [24]. The chance to be recognized more positively by the recruiter is to mention similarities. That somebody is doing something which is of interest for the recruiter. The involved recruiter remembers the candidate more easily. The personalization of the application supports the success of the candidate to get the job. The response opportunity to analyze that behavior is “to collect information to get the opportunity to personalize my application e.g. mention my university because the recruiter visited the same university, or I have the same hobby as the recruiter”. The collected information is very useful for the potential candidate and allows them to make their application unique and to stand out compared with other applications. The preparation for an interview is important to be successful. Those candidates are informed about the company and know the company well. SNS profiles provide information which can be used for the interview and to understand the company more deeply [25]. That has been the reason to provide the answer opportunity “to improve the interview with the company”. The potential candidates are on an advanced level in the recruiting process if they are invited for an interview. They have a good chance to get an offer and have to prepare their interview to be successful. Pictures are important for individuals and they are interested to have a picture from their contact person. The importance of the picture can be a cultural issue and that has to be under consideration for further interpretations. That they know the person more deeply and they get an idea about the dress code in the company. Further important is for the interviewer to recognize the person. The answer opportunity is “to have a picture from my contact partner”. A picture of a person is important for the first impression and can create sympathy. That would support potential candidate decision to change the status from potential candidate to applicant.

4 Method and Demographic Information

The data has been collected with a project at University of Ludwigshafen (Germany). The invitation to participate in the survey with a link to the questionnaire have been sent to 990 randomly selected individuals in Germany and the analysis uses 362 respondent answers. Not all respondents answered all required questions; in total 464 participants started to fill in the questionnaire. The data has been collected in April/May 2017 with an online survey. The online survey is useable because the research is about SNSs and the user of SNSs has access to the internet [26]. The individuals have to evaluate the answers on a scale from 1 - full agreement to 6 - full disagreement. The Gender distribution is 33.3% men and 66.7 women (n = 273).

Table 1. Main information on demographic indicators of respondents (gender, age, social status and education)

Social status	Share (in %)	Age distribution	Share (in %)	Age distribution	Share (in %)
Employed	48.9	Under 18 years	0.4	36–40 years	2.2
Unemployed	0.7	18–20 years	9.1	41–45 years	1.1
Student	40.9	21–25 years	40	46–50 years	4.4
School student	7.7	26–30 years	20.4	51–55 years	6.9
Retired	1.8	31–36 years	9.5	Over 56	6.2
n = 274	100			n = 275	100

Source: Tom Sander conducted survey in 2017

The research uses a six-point Likert scale because the German school grading system is from one to six. The use of the German school mark system supports the participants to evaluate the statements and simplify for the participants to answer the questions. The majority of the participants are under 30 years old. This age group is regularly using SNSs and will be searching for an employment opportunity in the near future.

This age group is trained and experienced with SNSs. The participants are very well educated, that is important to identify and to get an interesting employment offer. The demographic data is summarized in Table 1.

5 Statistical Results for Business Network Sites

The first analysis and evaluation is about business SNSs. The assumption is that business SNSs are more suitable for employment relevant issues. That people use this page for business relevant tasks e.g. to identify employment and their behavior is business related. The indicators of the descriptive statistics are presented in Table 2.

Results of survey participant evaluations on the statement that individuals use business SNS profiles to improve the interview with the company have covered all evaluations on evaluation scale (from 1 to 6) with arithmetic mean 2.22, median is two and mode is one: it means that this aspect is of great importance for respondents. The variability of responses is the smallest among other evaluations of the analyzed items (it has the smallest standard deviation). The alike results of respondent evaluations have the item “to have a picture from my contact partner” – with covered all evaluations on evaluation scale (1 to 6) with arithmetic mean 2.17, median is two and mode is one. The variability of responses is the second smallest among other evaluations of the analyzed items (it has the second smallest standard deviation).

Table 2. Main indicators of descriptive statistics of survey results on the analysis of the items for business SNSs

Evaluated aspects	n	Mean	Median	Mode
Because there are realistic information about the company (compared with official sources)	359	2.72	3	2
To improve the interview with the company	360	2.22	2	1
To investigate the qualifications which are important there	360	2.35	2	2
To investigate the duration of employment of the employees	358	3.16	3	3
To investigate possible career opportunities in the company	362	2.54	2	2
To have a picture from my contact partner	358	2.17	2	1
To collect information to get the opportunity to personalize my application e.g. mention my university because the recruiter visited the same university	358	2.96	3	2

Source: Tom Sander conducted survey in 2017, evaluation scale 1–6, where 1 - full agreement; 6 - full disagreement, n = 362

The importance of visual information compared with other factors is confirmed. The item “to investigate the qualifications which are important there” is evaluated with median and mode two, that means this information is important for individuals and they use SNS profiles to collect this information. The factor “To investigate possible career opportunities in the company” has the median and mode two. This is an additional information which is not available e.g. in job advertisements. The opportunity to collect additional information, “because there are realistic information about the company (compared with official sources)”, is rated with a median of three and mode two. The advantage to collect more information is not as good evaluated compared with other results. The item “to collect information to get the opportunity to personalize my application e.g. mention my university because the recruiter visited the same university, or I have the same hobby as the recruiter” is rated with median three and mode two. That is another item regarding opportunities to collect information with the profile from business SNSs. The factor with the weakest tendency of respondent evaluations to full

agreement is “to investigate the duration of employment of the employees” with median and mode three. This is information which is not as important compared with the other items. Evaluations by respondents on all items tend to full agreement. That is an indicator that business SNS profiles of the recruiter are of interest for potential candidates.

The results of the indicators of central tendency or location - median and mode are represented with the frequency of evaluations by respondents. The item “to have a picture from my contact partner” has on the first three stages on the evaluation scale 84.4% which is a strong result – most of respondents are close to “full agreement with the respective statement. The next item is “to improve the interview with the company” with 85.5% on the first three stages on the evaluation scale has the results more distributed (bigger variability) compared with the former item. The item “to investigate the qualifications which are important there” has 81.1% on the first three stages on the evaluation scale. The evaluations by respondents are on the first three stages on the evaluation scale with 76.5% for “to investigate possible career opportunities in the company” but the tendency to full agreement is not as strong as for the items before. The factor “because there is realistic information about the company (compared with official sources)” has 75.2% on the first three stages on the evaluation scale that support the importance of visual impressions. On the last place is with 62.2% on the first three stages on the evaluation scale is evaluated item “to investigate the duration of employment of the employees”. The importance of business SNSs profiles is confirmed because all items have over 62% on the first three stages on the evaluation scale and four items have more than 75% on the first three stages on the evaluation scale. Respondents indicated a clear tendency in their evaluations to full agreement. The correlation coefficient for “duration of use of business SNSs in minutes per day” is negative. It means that business SNSs users with more experience are fewer “investigate the qualifications which are important there”. The second factor is number of contacts on private SNSs. That means the membership and use of private SNSs influence the use of business SNSs.

6 Results on Analysis of Use of Private Social Network Sites for Employment Information

The next part is under consideration of private SNSs. The assumption is that private SNSs are more related to hobbies or leisure time. People exchange information about their private life there and less about issues relevant for employment. This section presents the statistical relevant results on evaluations for use of private SNSs.

The mode and median for the factor “to have a picture from my contact partner” are 2 from evaluation scale 1–6. That means the tendency is mainly to full agreement and private SNSs are a good place for pictures. The next two items are “to collect information to get the opportunity to personalize my application e.g. mentions my university because the recruiter visited the same university, or I have the same hobby as the recruiter” and “to improve the interview with the company” – the evaluations by respondents have the median three and mode two. That means individuals agree that they can use private SNS to prepare the interview and application with information

from the profile of private SNSs. The item “because there is realistic information about the company (compared with official sources)” has the mode and median of three and average evaluation by respondents was 3.57, which is compared to business SNSs less important. Two further items are “to investigate the qualifications which are important there” and “to investigate possible career opportunities in the company” have the median three and mode six with arithmetic mean 3.53 of evaluations (in scale 1–6). The mode six is a clear indication that a large group of participants do not agree that those two items are of interest for the employment seeking process. On the last place is the item “to investigate the duration of employment of the employees” with the mode three and six and the median four with arithmetic mean 3.81 of evaluations by respondents. The results in detail are presented in Table 3.

The results of the calculations are supported with the frequency. The strongest tendency with 75.3% on the first three stages of the evaluation scale has the item “To have a picture from my contact partner”. The second place is “To improve the interview with the company” with 60.9% on the first three stages of the evaluation scale. The result of 52.3% on the first three stages of the evaluation scale has the item “To investigate the qualifications which are important there”. The item “To investigate possible career opportunities in the company” - the frequency on the first three stages of the evaluation scale is 50.1% and the frequency for the item “Because there is realistic information about the company (compared with official sources)” is the frequency on the first three stages of the evaluation scale 51.9%.

Table 3. Main indicators of descriptive statistics of survey results on the analysis of the items for private SNSs

Evaluated aspects	n	Mean	Median	Mode
Because there are realistic information about the company (compared with official sources)	331	3.57	3	3
To improve the interview with the company	330	3.21	3	2
To investigate the qualifications which are important there	329	3.53	3	6
To investigate the duration of employment of the employees	328	3.81	4	3 and 6
To investigate possible career opportunities in the company	329	3.61	3	6
To have a picture from my contact partner	333	2.67	2	2
To collect information to get the opportunity to personalize my application e.g. mention my university because the recruiter visited the same university	331	3.54	3	2

Source: Tom Sander conducted survey in 2017, evaluation scale 1–6 where 1 - full agreement; 6- full disagreement

The next item is “To collect information to get the opportunity to personalize my application e.g. mentions my university because the recruiter visited the same

university, or I have the same hobby like the recruiter” has on the first three stages of the evaluation scale 51.9%.

The last place has “To investigate the duration of employment of the employees” with the frequency of 46%. There is only one item above of 75% and all other items are below 61% on the first three stages on the evaluation scale.

The next evaluation is to investigate the Spearman correlation coefficient to investigate the data. The use of private SNSs is influenced by factors from the use of business SNSs. The private SNSs have more significant relevant correlation coefficients than business SNSs. The first analyzed item is “To improve the interview with the company” and the factor “duration of membership of business SNSs in years” (Spearman Correlation coefficient 0.0234, Sig (2-tailed) 0.005, n = 144).

The results of this correlation analysis mean that if the person is longer user of SNS than the evaluations for item “To improve the interview with the company” increase and taking into account that evaluation scale is 1–6, where 1 - full agreement; 6 - full disagreement; it means that if the person is longer user of SNS than SNS does not support improvement the interview with the company.

The next factor which influences the use of private SNSs for the employment seeking process is the factor “Number of contacts at private SNSs”. There are four significant relevant items included in analysis and that is an indication that the “number of contacts at private SNSs” has a deep influence for individuals to use private SNS for the employment seeking process. The results of correlation analysis are in Table 4.

Table 4. Spearman correlation coefficient for private SNS on a relevant statistically significant level for the factor “Number of contacts at private SNS”

	Because there is realistic information about the company (compared with official sources)	To improve the interview with the company	To investigate the qualifications which are important there	To investigate possible career opportunities in the company
Spearman correlation coefficient	0.15	0.183	0.213	0.177
Sig. (2-tailed)	0.018	0.004	0.001	0.005
N	246	245	245	245

Source: Tom Sander conducted survey in 2017, n = 362

The evaluations by respondents on last factor “Number of contacts at business SNSs” has with the items “To improve the interview with the company” (Spearman Correlation coefficient 0.302, Sig. (2-tailed) > 0.000, n = 144) and “to investigate the qualification which are important there (Spearman Correlation Coefficient 0.219, Sig. (2-tailed) 0.008, n = 145). The use of business SNSs influences the use of private SNSs. Further is of interest that the item “To improve the interview with the company”

is significant influenced by three factors and “to investigate the qualifications which are important there” is influenced by the number of contacts for business and private SNSs.

The correlation coefficients are on a weak level and all positive. Especially under consideration is the amount of significant relevant statistical correlation with the numbers of contacts on private and business SNSs. That means the influence on private SNS is related to the number of contacts.

7 Summary and Conclusion

The results of the survey data provide the findings that individuals use SNSs profiles to collect information. They use the collected information to have an advantage. That is an indicator that the social capital theory can operate in virtual social networks and that there are similar mechanisms to real social networks. The functionalities and operations of SNSs can be explained with social capital theory.

The individuals often use SNSs also for the employment seeking process. The profiles of employees are an important information source for employment seeking individuals. Companies need this information that they can prepare the SNSs profiles and consult their employees to create beneficial SNSs profiles to be an attractive source for potential candidates that potential candidates are motivated to apply for respective job position in the company. The profiles should have information about career opportunities and needed skills but most important is a picture on the SNSs profile. This kind of branding can be supported with corporate identity guidelines and supported with information by the communication departments. The most important point would be that the management makes their employees aware that they represent the company with their SNS profiles and they are responsible that their profile does not damage the company reputation. The SNS profiles are recognized by other individuals and used as a source to collect needed and useful information. The ethical and juridical difficulty would be the power of companies on private or business SNS profiles. One assumption would be that employees would be not amused if they have to change their private SNS profiles under consideration of company relevant regulations. That would be another topic which needs further research.

The difference in use of SNSs between private and business SNSs is clearly visible. Business SNSs have a higher tendency to be suitable compared with private SNSs profiles. This could guide companies to the opinion to concentrate their resources on business SNSs profiles to be successful. Further is the number of correlations between the investment (duration of membership, number of contacts and duration of use of SNSs in minutes per day) in private and business SNSs and the employment seeking process are different for analysed groups. Private SNSs have more statistical relevant correlations compared with business SNSs. That means further research is needed to identify suitable indicators to predict the behavior of individuals at SNSs.

The results need further research and investigations to identify more factors and explanations how SNSs can be used for the employment seeking process and to evaluate the power of influence of SNSs for the individuals, companies and societies to use SNSs successfully. This paper provides a basis for further needed research.

References

1. Brady, G.: Network social capital and labour market outcomes: evidence for Ireland. *Econ. Soc. Rev.* **46**(2), 163–195 (2015)
2. Sander, T., Sloka, B., Pauzuoliene, J.: The difference of social network sites explained with the employment seeking process. *Reg. Formation Dev. Stud.* **3**(17), 145–153 (2015)
3. Melanthiou, Y., Pavlou, F., Constantinou, E.: The use of social network sites as an e-recruitment tool. *J. Transnatl. Manag.* **20**(1), 31–49 (2015)
4. Song, J., Walden, E.: How consumer perceptions of network size and social interactions influence the intention to adopt peer-to-peer technologies. *Int. J. E-Business Res.* **3**(4), 49–66 (2007)
5. Ferreira, A., Antunes, F.: Essential functionalities for commercial internet presence. *Int. J. E-Business Res.* **11**(1), 56–83 (2015)
6. Sander, T., Teh, P.L., Sloka, B.: Your social network profile reveals you. *Int. J. Web Inf. Syst.* **13**(1), 14–24 (2015)
7. Moran, G., Muzellec, L.: eWOM credibility on social networking sites: a framework. *J. Mark. Commun.* **23**(29), 149–161 (2017)
8. Miranda, F.J., Rubio, S., Chamorro, A., Loureiro, S.M.C.: Using social networks sites in the purchasing decision process. *Int. J. E-Business Res.* **10**(3), 18–35 (2014)
9. Gayen, K., McQuaid, R., Raeside, R.: Social networks, age cohorts and employment. *Int. J. Sociol. Soc. Policy* **30**(5/6), 219–238 (2010)
10. Sander, T.: New circumstances for the labor market under the consideration of social media. *Commun. Glob. Inf. Technol.* **5**, 41–52 (2013)
11. Olaleye, S.A., Salo, J., Ukpabi, D.C.: The role of reputation on trust and loyalty. *Int. J. E-Business Res.* **14**(2), 61–75 (2018)
12. Ollington, N.: Online social networks: an emergent recruiter tool for attracting and screening. *Pers. Rev.* **42**(3), 248–265 (2013)
13. Ellison, N.B., Steinfield, C., Lampe, C.: The benefits of facebook “friends:” social capital and college students’ use of online social network sites. *J. Comput. Mediat. Commun.* **12**, 1143–1168 (2007)
14. Sabatini, F., Sarracino, F.: Will Facebook save or destroy social capital? An empirical investigation into the effect of online interactions on trust and networks (No. 30). Köln (2014)
15. Boyd, D.M., Ellison, N.B.: Social network sites: definition, history, and scholarship. *J. Comput. Mediat. Commun.* **13**(1), 210–230 (2007)
16. Zide, J., Elman, B., Shahani-Denning, C.: LinkedIn and recruitment: how profiles differ across occupations. *Empl. Relat.* **36**(5), 583–604 (2014)
17. Wilson, R.E., Gosling, S.D., Graham, L.T.: A review of Facebook research in the social sciences. *Perspect. Psychol. Sci.* **7**(3), 203–220 (2012)
18. Sander, T., Teh, P.L., Sloka, B.: Use of social network site’s profile for the employment seeking process. In: Rocha, A., Correia, A.M., Costanzo, S., Reis, L.P. (eds.) *New Contributions in Information Systems and Technologies*, vol. 1, pp. 1023–1032. Springer, Heidelberg (2015)
19. Klumper, D.H., Rosen, P.A.: Future employment selection methods: evaluating social networking web sites. *J. Manag. Psychol.* **24**(6), 567–580 (2013)
20. Nikolaou, I.: Social networking web sites in job search and employee recruitment. *Int. J. Sel. Assess.* **22**(2), 179–189 (2014)

21. Teh, P., Huah, L.P., Si, Y.: The intention to share and reshared among the young adults towards a posting at social networking sites. In: Rocha, Á., Correia, A.M., Tan, F.B., Stroetmann, K.A. (eds.) *New Perspectives in Information Systems and Technologies*, vol. 275, pp. 13–21. Springer International Publishing, Cham (2014)
22. Peterson, C., Park, N., Seligman, M.: Orientations to happiness and life satisfaction: the full life versus the empty life. *J. Happiness Stud.* **6**(1), 25–41 (2005)
23. Badger, J.M., Kaminisky, S.E., Behrend, T.S.: Media richness and information acquisition in internet recruitment. *J. Manag. Psychol.* **29**(7), 866–883 (2014)
24. Flanagan, J.R., Peterson, M., Dayton, C., Strommer Pace, L., Plank, A., Walker, K., Carlson, W.S.: Email recruitment to use web decision support tools for pneumonia. In: *AMIA Annual Symposium Proceedings*, pp. 255–259 (2002)
25. Roebken, H.: Similarity attracts: an analysis of recruitment decisions in academia. *Educ. Manag. Adm. Leadersh.* **38**(4), 472–486 (2010)
26. Evans, J.R., Mathur, A.: The value of online surveys. *Internet Res.* **15**(2), 195–219 (2005)



Econometric Modeling of Wage Discrimination Towards Women in the Accounting Profession

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Abstract. This research analyzes the factors that affect to wage discrimination of women in the accounting profession. Wage discrimination takes place when men and women receive unequal pay for the same job. This paper, using econometrics modeling, show the existence of wage discrimination among accounting professionals and the variables that determine it. The results provide information about that gender wage discrimination exists, and that the factors that cause it in this group of professionals are years in college, compliance with salary, age, professional degree, job satisfaction, college satisfaction, the type of company in which they work (public, private or mixed), and the size of it and labor mobility.

Keywords: Wage discrimination · Accounting professionals · Econometric modeling

1 Introduction

Individuals incur educational expenses along with opportunity cost, by not earning incomes during their education, convinced that in the future their training will give them the possibility to earn higher rents [1]. The theory of human capital states that both, years of college and work experience should increase in linear manner the productivity of workers and, therefore, their future salary [2]. While it is true that these variables affect the remuneration of individuals, there are others such as occupation, productive sector, productive sector and gender that influence the salary of individuals [3]. In terms of gender, the theory of human capital refers to the fact that there is lower remuneration of women and gender segregation because women may prefer certain types of work and companies prefer to employ them in certain occupations; it is a social construction created from gender differences, which culturally distinguish women from men and attribute different characteristics to each.

Based on the theory, individuals who have the same years in college, equal professional title and institution, should obtain similar remunerations, when they perform work with the same conditions. However, in practice significant salary differences can

be found between men and women. Which increase in those who have studied programs related to administrative economic sciences [3].

One of the problems that women have had to face to enter workforce, has been wage discrimination. Although the International Labor Organization (ILO) declares the right to equal pay since 1919 as a basic principle established in the initial lines of the Constitution of the ILO [4], where it was recognized as a key element for social justice, this in practice is not fully met.

Historically, there has always been a strong differentiation of treatment in the workplace towards women. In this sense, one of the aspects where this inequality is most evident is in wage discrimination, in this respect several studies have emerged, where empirical evidence of this phenomenon is shown internationally [5–7].

Wage discrimination attributable to gender occurs strictly in the labor market, because it refers to the wage differences applied to male and female workers in the same job position, it can be added that this wage discrimination can be observed not only when men and women earn a different salary for the same job but also when there are discrepancies in remuneration for performing a job that requires equal endowments, such as skills, effort, responsibility, and working conditions [8]. In this context, it is pointed out that when a person receives a lower remuneration for the mere fact of having a certain sex, it is called direct wage discrimination, and when certain factors are considered in a certain job that could lead to benefit one or another sex, that is called indirect wage discrimination. Finally, it is established that when the only reason for these differences is their biological condition, that is to say, the male or female sex, that is called discrimination by sex. Although, broadly speaking, the wage discrimination of women also takes place in the access to employment.

However, following the conceptualization formulated by the International Labor Organization (ILO), unequal treatment involves multiple aspects of employment such as pension coverage, the conditions in which the job is carried out, schedule, of promotion opportunities, among others. Nevertheless, wage differentials have a particular relevance. In this sense, the existence of different payment for workers who have equivalent skills and who perform jobs with the same characteristics is considered wage discrimination, this disparity is based exclusively on belonging to a particular group based on race, sex, religion or another that has no relation to the work performed.

The gap between the remuneration of a man and a woman considers all types of income as cash or in-kind remuneration, net self-employment income and total income from self-employment or by others. On a global scale, it is estimated that the gender wage gap is 22.9%. However, the extent of the wage gap between men and women varies according to the sector, occupation, group of workers, country and time. It is usually lower in the public sector compared to the private and is higher in older workers. It is also important to note that exist several factors that explain this wage gap, and it takes place mainly due to differences in education and training by gender, work experience, occupational segregation, working hours (part or full time), size of the company and rate of unionization, and salary discrimination by sex. This segregation is clearly noticed when there are jobs that are associated to women, such as babysitter, house maid, secretary, etc. they have lower wages than the jobs associated with men such as miner, machinist, truck driver, etc. This is called horizontal occupational segregation [9].

Likewise, studies at international level show that wage differences between sexes are mainly due to the segregation of women in certain labor structures. Evidence shows that a significant proportion of the salary difference is explained by the unequal distribution of men and women in employment, at least 20–25% of the wage gap [10]. There are also wage differences between feminized and masculinized careers, being the first less remunerated than the second [11].

In Chile, a series of studies have been carried out showing that there is a wage gap between men and women that is not explained by differences in productivity, but rather, could be explained by gender discrimination. In this sense, studies show that men and women are paid differentially for their years of experience [12]. In this sense, the Report of the World Economic Forum of 2013 positioned Chile as one of the countries in which the salary difference between men and women for the same job is one of the largest in the world [13].

Gender pay gap in Chile is not a minor aspect, especially considering that in recent years' women's labor participation has grown strongly, from 44.3 to 48.7% from early 2010 to 2014, which represents an increase of 4.4 percentage points, almost 60% more than in the previous four-year period. Also, not only the labor participation of women has increased, but also the employment rate, an indicator of particular importance since it expresses the proportion of women who actually have a job, figure that moved from 39.5 to 45.3% during the period 2010–2014 [14].

The main change in the female role occurred in the eighties, due to better education and training [15]. This generation produced more qualified women for the world of work. Consequently, women who work today in important positions are protagonists of a cultural and social change that advances slowly, but that little by little has changed the society in which we all coexist [16].

Thus, in the present investigation, the existence of wage discrimination by gender in the professionals of the administrative accounting area in Chile will be identified, and the variables that affect this discrimination will be identified as well.

2 Methodology

This research was developed through a case study to the graduates of the career of Public Accountant and/or Auditor at Universidad del Bío-Bío located in the Bío-Bío Region in Chile.

The study was developed through the application of surveys to the 2002–2011 graduates. The validation of the survey was carried out by two means, “Expert Judgment” and “Application of a pilot test”. The sample was calculated from a total population of 834 graduates of both study plans, Public Accountant and Public Accountant and Auditor. A sample error of 6.8% and a confidence level of 95% were determined, which gives a sample of 166 subjects.

On the other hand, the database of the Ministry of Education published on the website MiFuturo.cl was used to establish the gap between the results obtained by graduates from Universidad del Bío-Bío versus the national average. The income information associated with the career published by the Ministry of Education is taken from the Higher Education institutions, that provide complete records of their

graduates; the cross check made by the Sub-directorate of Studies from the Internal Revenue Service (known in Chile as SII) on the basis of the tax records, and the processing and validation carried out by the Higher Education Information Service (known in Chile as SIES), of the Ministry of Education.

The information available refers practically to the total number of graduates from higher education institutions who started commercial activities at SII and corresponds to graduates of higher education from generations 2000, 2001, 2005, 2006, 2007, 2008 and 2009, which were grouped as; the income to the 5th year of degree corresponds to the income received by the cohort of graduates 2005 and 2006; to the 4th year the income received by the cohort of graduates 2005, 2006 and 2007, to the 3rd year, the average income received by the 2006, 2007 and 2008 cohorts; In the 2nd year, cohorts of graduates 2007, 2008 and 2009 and 1st year of degree correspond to the average income received by the cohorts of graduates 2008, 2009 and 2010. This same methodological basis was used to determine the average income of graduates from Universidad del Bío-Bío, which was calculated separately by gender.

The analysis is performed for variables such as: age, degree obtained, years of work experience, type of company (public, private or mixed), industrial sector to which the contracting company belongs, size of the company, degree of compliance with the income and the existing gap with the national average.

In the research, the LSD Fisher and the Tukey Tests were used to verify if the differences of the observed gaps turned out to be statistically significant. In addition, hypothesis tests were carried out for the statistical average in order to determine the level of significance of the remuneration gap at Univesidad del Bío-Bío and the national average, for each of the genders. Finally, an econometric model was generated to determine the main determinants of the salary of the auditor accountants from Universidad del Bío-Bío.

3 Results

3.1 Descriptive Analysis

When analyzing the sample data it is observed that of a total of 166 respondents, 59% are female, who receive an average income of CLP \$870,811 and 41% of male gender whose average income is CLP \$1,063,076, showing a gap of 18% between both, which means that women earn 82% of what men earn for this profession, although this difference is below the national average for University students of 34.5%, and below 32.1%, of the Bío-Bío Region showing even higher average rents both men and women to the national and regional average. This income difference by gender is statistically significant, with a p value = 0.0153 (P-value = <0.05). However, when analyzing income received per age group, it is observed that the income of graduates between 36 and 40 years of age is significantly higher than the income received by those under the age of 26, with a 5% significance level. However, when performing the same analysis by gender, it is observed that the greatest wage gap is between 31 and 35 years with 25% and the lowest is between 26 and 30 years with 7%, but between 36 and 40 years the gap is negative, where women have a higher income by 29% than the one earned by men in the same age group, nonetheless, these differences are not statistically significant.

When analyzing the income received by degree obtained, it can be seen that the Auditor Accountant graduates receive an average income of CLP \$1,070,035 while the Public Accountants and Auditors CLP \$742,213. This difference is statistically significant considering a level of significance of 5%, however, when analyzing the income by gender, it is observed that the salary gap between those who hold the title of Auditor Accountant is 16%, instead in the Public Accountant and Auditors, this gap is only 2%, however, these differences do not turn out to be significant when applying the statistical tests ($P\text{-value} = <0.05$).

With regard to the income received according to years of experience, it is observed that, the greater number of years in the labor market, the higher the incomes received, however, this gap becomes statistically significant, only when comparing the one received by graduates with more than 12 years of experience and those with less than 2 years of experience, considering a level of significance of 5%. However, when performing this analysis separated by gender, it was determined that the greatest wage gap is located at 11 years of work experience with 88% and the lowest at 6 years of experience with 8%, while at 7 years of experience a better income is observed for women, surpassing men by 35%, however, these differences were not statistically significant ($P\text{-value} = <0.05$).

Meanwhile, if we analyze the type of company in which the graduates work and the income they receive, a significant difference can be seen between the public and private sectors ($P\text{-value} = <0.05$). However, if the analysis is complemented with the gender, it is observed that there are no statistically significant differences between the income received in the public sector, where the remuneration gap is only 1% and in this case favorable to women, since, in these types of companies, gender differences are not made for the determination of the remuneration to be paid, this could be explained by the existence of a single scale of salaries for this type of companies. However, in private companies, where the difference in remuneration received by gender is more evident, with a salary gap of 27%, which means that women earn only 73% of what men earn by working in this same type of companies, which is finally ratified by the Fischer Test, where with a level of significance of 5% the difference in income perceived in the private sector by the graduates of both genders, is significant ($P\text{-value} = <0.05$).

On the other hand, if we compare the income obtained by graduates according to industrial sector that their companies belong to, there are no significant differences between them, this remains by performing this same analysis by gender, although, the greatest wage gap observed among companies is found in the category of manufacturing companies where it reaches 39% and the lowest wage gap observed in financial companies with only 6%.

The size of the company is a relevant factor when it comes to link it to the level of remunerations reached, since there is a clear relationship between the size and the income earned by the respondents, for both genders. In the same way, it is observed that in large companies the gender wage gap is shortened from 47% in small companies to 10% in large companies. This is reaffirmed statistically since when applying the Fisher LSD Test considering a level of significance of 5%, it is observed that there are significant differences between the salaries paid by large companies and medium-sized companies ($P\text{-value} = <0.05$). Then, when carrying out this same analysis separated by

gender, it can be observed that incomes obtained by the male respondents who work in small companies is significantly higher than the female subjects who work in these same types of companies. However, if the income obtained is compared to all those who work in large companies, no significant differences are perceived according to gender, which clearly shows that small companies are the ones that make this differentiation when deciding the income to be paid to these professionals.

On the other hand, it is observed that the degree of compliance with the perceived income changes as this increase, however, this is statistically significant in ranges from moderately satisfied to satisfied or very satisfied ($P\text{-value} = <0.05$). However, when analyzing this effect according to gender, there are no significant differences in terms of their degree of compliance with the received income, however, the largest wage gap is found among those graduates who state they are very dissatisfied with a gap salary of 46%, and the smallest gap observed among those who declare themselves as very satisfied with their income, which in this case is 16% but in favor of women.

In as much, it is possible to see that graduates from career of Public Accountant and Auditor of Universidad del Bío-Bío, are in better position than the national average in the first, second and third year of graduates, nevertheless, this situation changes in the fourth and fifth years of graduation, where income is relatively lower, although in all cases the gaps are narrow. However, this gap is statistically significant ($P\text{-value} = <0.05$) only in the first year in a positive way, and in the fifth year with a level of significance of 10%, but in this case, it is unfavorable for these graduates.

With respect to the gap in the first three years, where Universidad del Bío-Bío is above the national average, it is in the first year of 13%, in the second year of 10% and in third year of 5%. Meanwhile, in the fourth and fifth year, where Universidad del Bío-Bío is below the national average, the gap is -2 and -10% respectively.

In the meantime, if this analysis is made comparing the income obtained by subjects according to gender with the national average, it is observed that in the case of female subjects they are in a better position in the first two years, with a 9.5% gender gap and 6% above the national average, from the third year it begins to fall, reaching a gap of 8.5%, however, these differences are not statistically significant ($P\text{-value} = <0.05$). Continuing the analysis with male subjects, it is observed a similar situation to the found at Universidad del Bío-Bío as a whole, where it can be clearly seen that in the first three years of degree they are above the national average with gaps of 22, 16 and 14% respectively, descending from the fourth year, reaching gaps of -6 and -13% , which are statistically significant ($P\text{-value} = <0.05$) in the first year, second and third year with a level of significance of 10%. In the fourth and fifth year of the degree, this gap is not significant.

3.2 Econometric Analysis

To identify and quantify the variables that explain the salary of accounting profession, an econometric cross-sectional model for this empirical application was used [17]. The exogenous variables in the model are as follows: gender, years in college, compliance with salary, age, professional degree, job satisfaction, college satisfaction, and the endogenous variable is salary.

The general model in its functional form is specified by the following equation:

$$salary_i = \beta_0 + \beta_1^* gender_i + \beta_2^*/years_college_i + \beta_3^* compliance_salary_i + \beta_4^* age_i + \beta_5^* professional_deg_ree_i + \beta_6^* job_satisfaction_i + \beta_7^* college_satisfaction_i + \mu_i \tag{1}$$

The estimation results of the model of Eq. 1 is possible to see in Table 1.

Table 1. Estimation of salary accounting profession

	Coefficient	Standard deviation	t	P-value
constant	1418470.119	174488.896	8.129	0.000
gender	94965.012	69280.646	1.371	0.102
years_college	-16065.311	19757.975	-0.813	0.417
compliance_salary	-196040.556	35628.128	-5.502	0.000
age	23796.229	50573.086	0.471	0.639
professional_degree	238229.325	83278.352	2.861	0.005
job_satisfaction	-46017.936	40286.200	-1.142	0.255
college_satisfaction	1937.235	44474.320	0.044	0.965

For the model presented in Table 1 we can observe, the individual significance levels for model variables at 95% (P-value = <0.05) and the joint levels (F-statistic: 12.728), with the exception of the variable gender which is 90% significant (P-value = <0.1) and years_college, age, job_satisfaction, college_satisfaction, which are not significant. The variability of the endogenous variable is explained in 42% of the sample by the variability of the exogenous variables. The model meets the assumptions of autocorrelation test (Durbin-Watson Test = 2.094, dl = 1.617, du = 1.832, $\alpha = 0.05$) and heteroscedasticity test (White Test = F-statistic: 0.821750; P-value = 0.7155) [18]. Additionally, the model presents adequate information criteria (Akaike: -6.665764; Schwarz: -6.412801; Hannan-Quinn: -6.565058) [19].

4 Conclusions

In this research, and based on the results obtained from the descriptive analysis, as well as the econometric model proposed, the variables that significantly contribute to the wage received by the Public Accountant and/or Auditor of the Universidad del Bío-Bío, Chile, are: gender, years of experience in the labor market, type of company in which they work (public, private or mix-to), size of the company, compliance salary and professional degree. On the other hand, wage discrimination by gender continues to be a reality in Chile, and persists this trend, in general male professionals perceive on average rents superior to those of the female gender, although it can be affirmed that the valorization of this professional is quite high since the average rents obtained by both men and women, exceeded the average obtained by the University students in the Bío-Bío Region, in the Metropolitan Region and Nationally.

References

1. Gary, S.: Becker: human capital, effort, and the sexual division of labor. *J. Labor Econ.* **3**(1), 33–58 (1985)
2. Becker, G.S.: *Human Capital. A Theoretical and Empirical Analysis with Special Reference to Education*, 3rd edn, pp. 3–330. The University of Chicago Press, New York (1993)
3. Rodríguez, R., Camberos, M.: Análisis de la discriminación salarial de la mujer en Hermosillo, Sonora. *Política y cultura* **28**, 225–256 (2007)
4. Oelz, M., Olney, S., Tomei, M.: *Igualdad salarial: Guía Introductoria*, Oficina Internacional del Trabajo, Departamento de Normas Internacionales del Trabajo, Primera Edición (2013)
5. Blau, F., Kahn, L.: The gender earnings gap: learning from international comparisons. *Am. Econ. Rev.* **82**, 533–538 (1992)
6. Blinder, A.: Wage discrimination: reduced form and structural estimates. *J. Hum. Resour.* **8**, 436–455 (1973)
7. Oaxaca, R.: Male-female wage differentials in urban labor markets. *Int. Econ. Rev.* **14**, 693–709 (1973)
8. de Cabo Serrano, G., Garzón, M.J.: *Diferencia y discriminación salarial por razón de sexo*, pp. 1–285. Centro de Estudios Económicos Tomillo, Instituto de la Mujer, Madrid, España (2007)
9. Oelz, M., Olney, S., Tomei, M.: *Igualdad salarial: Guía Introductoria*, Oficina Internacional del Trabajo, Departamento de Normas Internacionales del Trabajo, Primera Edición, Suiza (2013)
10. Hakim, C.: Explaining trends in occupational segregation: the measurement, causes, and consequences of the sexual division of labour. *Eur. Sociol. Rev.* **8**(2), 127–152 (1992)
11. Schurch Santana, R.: El retorno de las carreras: un estudio de caso de los factores que inciden en las remuneraciones de universitarios recién titulados. *Calidad en la Educación* **38**, 215–244 (2013)
12. Peticara, M., Bueno, I.: Brechas salariales por género en Chile: un nuevo enfoque. *Revista Cepal.* **99**, 133–149 (2009)
13. World Economic Forum, WEF: *The Global Gender Gap Report 2013*, Suiza (2013)
14. Gobierno de Chile: *Informe de Políticas Públicas N° 10 Avances de la Agenda Laboral para las Mujeres durante el Gobierno del Presidente Sebastián Piñera*, 30 de Abril de (2014)
15. Sarasa, J.L.: Implicación sociolaboral de la mujer en áreas rurales remotas. *Papeles de Geografía* **37**, 13–26 (2003)
16. Pizarro, O., Guerra, M.: *Rol de la mujer en la gran empresa*. Centro de estudios empresariales de la mujer, pp. 1–58. Universidad del Desarrollo, Santiago, Chile (2010)
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.* 1–9 (2016). (4630492)
18. 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)
19. 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)



High Performance Work Systems and Employee Turnover Intentions: Moderating Effect of Psychological Attachment

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Abstract. In the world of business today, consolidating human resource policies and practices into High-Performance Work System has become crucial not only for employees and organisational success, but also for achieving competitive advantage. Accordingly, extant literature argues that high-performance work systems has a direct effect on individuals behaviour rather than been influenced by other variables. The aim of this paper is twofold. First, to examine the relationship between high-performance work systems and employee turnover intention. Second, to test the moderating effect of psychological attachment on high performance work systems and turnover intention. For the purpose of achieving the objectives of this study, the research adopted a cross-sectional and correlating survey design. A multi-staged sampling technique was used to sample two hundred and twenty-four (224) employees from the Ghanaian banking sector. Both correlation and regression analysis were used to test relationship and predictability of outcome variable by the predictor while Hayes PROCESS was used to test for moderation. Results revealed that there was a negative relationship between high-performance work systems and psychological attachment. It was also found that a negative relationship exist between high-performance work systems and employee turnover intention. Additionally, psychological attachment is found to moderate the relationship between high-performance work systems and turnover intention. It is however argued that employees will seek other opportunities elsewhere if human resource policies and practices does not lead to commitment or being psychologically attached to the organisation.

Keywords: High-performance work systems · Psychological attachment · Turnover intention

1 Introduction

High performance work systems are key invention of recent management; and have had modern important effect on individual and organizational performance. The idea of high-performance work system was based on the assumption that there exist systems of

work practices for workers in an organization that somehow leads to higher performance. [1] explained high performance work system as a system that is being implemented in an organization to enhance the employees' performance and productivity. High performance work system has proven to be particularly valuable. According to [2], high performance work systems have been attributed to higher individual performance and lower employee turnover intention. High performance work systems represent a systematic and integrated approach of managing human resources that align human resource functions to the achievement of firms' strategy [3]. As argued by [4] high performance work systems comprise some fundamental human resource practices such as; careful selection procedures, internal merit based promotions, grievance procedures, cross-functional and cross trained teams, high level of training information sharing, participatory mechanism and skilled-based pay. Implementing HRM practices in an effective way has contributed to the development of a skilled workforce [5]. This expectation has led to a significant research stream aimed at testing for performance gains and comparing research on the potential effects employee turnover has been rare until recently [6] but such studies are important in their own right, as policies that can decrease employees turnover are essential to the industrial landscape, at most because there is strong evidence that stress at work extends to general health and negative perceptions [7–9].

Existing literature on high performance work systems has examined its effects on employee work-related outcomes such as job satisfaction, organisational commitment and turnover intention. However, there paucity of information regarding the moderation effect psychological attachment in the relationship between high-performance work systems and employee turnover intention. Psychological attachment refers to a deep and enduring emotional bond that connects one person to another across time and space [10, 11]. This attachment is characterized with: a safe heaven, a secure base, proximity maintenance and separation distress [11]. Attachment can also be perceived as a behavioural system where a feeling of security and actual condition of safety are significantly associated. The fundamental goal of the system is to regulate behaviours designed to maintain proximity to and contact with those that are regarded as attachment figures [12]. Bretherton suggests further that attachment behaviours tends to be noticeable when the attached person is frightened, fatigued, or sick and is assuaged when the attached figure provides comfort, protection and assistance.

Few studies have examined how human resource (HR) practices influence employee's intention to leave [13] and fewer have examined the psychological attachment of employees to the job. Although there is increasing research on HPWS and its effect on performance, many unanswered questions remain in this field as to whether it influences employees decisions to leave or to be attached [14–16]. It is of no doubt that research on high performance work systems has received considerable criticism in recent years for its "highly management –centric standpoint", which places much emphasis on management goals over employee well-being [17]. Also, earlier studies on high performance work systems either disregard employee outcomes or treat employee's outcomes only as mediating variable that links mechanisms between HPWS and organizational effectiveness, with the goal of enhancing performance [18–20]. As the debate of linking high performance work systems to organizational and behavioural outcomes continues, scholars such as [21–25] all argue that a carefully

planned and executed HR practices has greater chances of affecting work outcomes such as employee turnover and counter-productive work behaviours. Consequently, [26] suggests that equal attention should be paid to managerial activities as well as involvement and well-being of employees. The intention is to avoid the marginalization of employee outcomes regarding HPWS research. In line with this assertion, [27] advanced that an industry which lacks participation is likely to experience high counter-productive work behaviour such as turnover intention which is eminent in the Ghanaian banking sector. The study further opined the lack of commitment in the sector because employees have alternative job opportunities. The need to establishing the moderating role of psychological attachment is critical as current literature has made it clear that the relationship between high performance work systems and turnover intention seems not direct. The aim of the study is to investigate the relationship between high performance work systems and employee turnover and also the moderating role of psychological attachment.

2 Research Hypotheses

Hypotheses are derived from objectives;

- H1: High performance work systems relate negatively with employee turnover.
- H2: Psychological attachment relates negatively with employee turnover.
- H3: High performance work systems relate positively with psychological attachment.
- H4: Psychological attachment will statistically moderate the relationship between high performance work system and employee turnover.

3 Methodology

3.1 Procedure

The study used a cross-sectional, descriptive, and correlational survey design in examining the moderating effect of psychological attachment in the relationship between high-performance work systems and turnover intention. The Population consisted of eighteen (18) financial institutions listed in the Ghana Club 100 Companies. Convenient sampling technique was used to select these banks based on their willingness to participate in the study as well as proximity. Secondly, almost all the banks have their headquarters in Accra and considered as center of all banking operations. Purposive sampling technique was then used to sample two hundred and twenty respondents. In order to adhere to international standards and ethics in research, organisations and participants were served with consent letters. This research implements a number of statistical techniques and procedures that help to analyze research hypotheses. These techniques include reliability and validity test, frequency analysis, descriptive statistics, correlation matrix and multiple regressions. All statistical procedures were estimated using Statistical Package for Social Sciences (SPSS). The researchers also employed the use of Process for SPSS 2.16.3 by Andrew Hayes for the analysis.

3.2 Instrumentation

High Performance Work System

The high performance work system scale was adapted from [28], the 20 item was divided into seven (7) different part which was scored on a likert scale with a range of 1–5 where 1 = strongly disagree, 2 = disagree, 3 = uncertain, 4 = agree, 5 = strongly agree. The instrument was piloted to determine its reliability and validity. A Cronbach alpha of .751 was recorded.

Psychological Attachment

The 12 item psychological attachment scale used in this study was developed by [29]. The item scale was scored on a Likert scale with a range of 1–5, where 1 = strongly disagree, 2 = disagree, 3 = uncertain, 4 = agree, 5 = strongly agree. The instrument was piloted to determine its reliability and validity. A Cronbach’s alpha of .842 was recorded.

Turnover Intention

[30] 10 item scale was used to measure the turnover intentions of the respondents. This 10 item scale was scored on a likert scale with a range of 1-5, where 1 = strongly disagree, 2 = disagree, 3 = uncertain, 4 = agree, 5 = strongly agree. The instrument was piloted to determine the reliability and validity of the scale. The Cronbach’s alpha of .853 was recorded.

3.3 Results

To test the hypothesis that employee turnover problems are a function of multiple risk factors, and more specifically whether psychological attachment moderates the relationship between high performance work system and employee turnover, Pearson product moment correlation coefficient and hierarchical multiple regression analysis was conducted. Hypothesis 1 revealed that a negative relationship exists between high performance work system and employee turnover ($r = -0.232, P < .000$). Hypothesis 2 also found that there was a negative relationship between psychological Attachment and turnover intention ($r = -.173, P < .000$). In Hypotheses 3, the correlation coefficient proved that a positive relationship exists between high performance work system and psychological attachment ($r = 0.380, P < 0.00$) as seen in Table 1.

Table 1. Correlational analysis of high-performance work system, psychological attachment and turnover intention.

Variable	Mean	SD	1	2	3
1. HPWS	3.4998	0.56978	1		
2. Psychological attachment	3.5945	0.72309	0.380	1	
3. Turnover intention	2.741	0.8366	-0.232	-0.173	1

Note: *Correlation is significant at the 0.05 level (2-tailed)

**Correlation is significant at the 0.01 level (2-tailed)

As showed in Table 2, Andrew Hayes PROCESS was employed to test this three-step moderation analysis in hypothesis 4. As depicted in the analysis, when High-Performance work systems (Predictor) was entered into the model the outcome was statistically significant. Secondly when the moderator (Psychological Attachment) was added to the model in step 2, the outcome was also found to be significant. In step 3, to avoid potentially problematic high multicollinearity with the interaction term, the variables were centered and an interaction term between psychological attachment and high performance work system was created [31]. When the interaction (High-performance work system x Psychological Attachment) was added to the model, the outcome was not significant. The interaction term recorded a beta coefficient of $-.2225$ and explained a significant incremental in variance in turnover due to the interaction ($\Delta R^2 = .0132$). Figure 1 depicts that psychological attachment moderated the relationship between high-performance work systems and turnover intention. As shown on the interaction plot, an increasing effect of psychological attachment on high performance work systems decreases turnover intention. Thus, an organization can adopt high performance work systems but if these systems do not enhance employee’s attachment, then turnover intention is likely to occur (Fig. 2).

Table 2. Process results for moderation analysis among high-performance work system, psychological attachment and turnover intention

Model 1. Outcome variable: Turnover Intention								
Summary:		R	R-sq	MSE	F	df1	df2	p
		.2842	.0807	.6523	5.7347	3.0000	218.0000	.0009
Variables		β	se	t	p	LLCI	ULCI	
Constant		2.7596	.0576	47.9508	.0000	2.6461	2.8730	
Psychological Attachment		-.1198	.0502	-2.3865	.0179	-.2188	-.0209	
High-Performance Work Systems		-.3270	.1072	-3.0489	.0026	-.5383	-.1156	
Interaction term (HPWS x Psychol Att)		-.2225	.1436	-1.5495	.1227	-.5055	.0605	
R-square increase due to interaction(s): HPWS x Psychol Att			R²-chng	F	df1	df2	p	
			.0132	2.4009	1.0000	218.0000	.1227	
Conditional indirect effects of X on Y:		Psychol Att.	Effect	BootSE	BootLLCI	BootULCI	t	p
HPWS	-> Psychol Att							
	-> TI							
		-1.3506	-.0265	.2002	-.4210	.3680	-1.3222	.8950
		.0000	-.3270	.1072	-.5383	-.1156	-3.0489	.0026
		1.3506	-.6275	.2411	-1.1027	-.1522	-2.6019	.0099

Note: N = 224. p is significant at .05; β denotes beta coefficient, LLCI, lower limit confidence interval, ULCI, upper limit confidence interval, Psychol Att, Psychological Attachment, TI, Turnover Intention, HPWS, High-Performance Work System

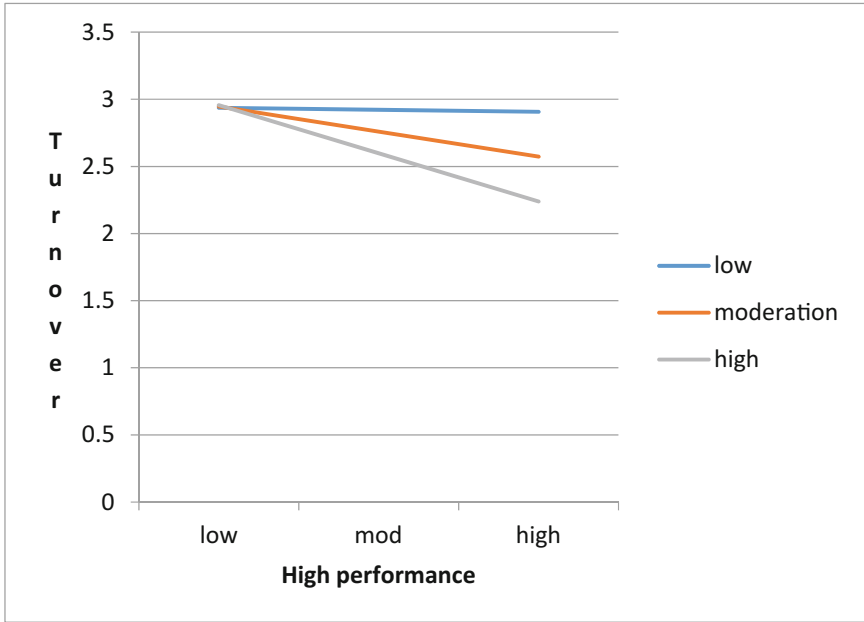


Fig. 1. Moderation effect of psychological attachment

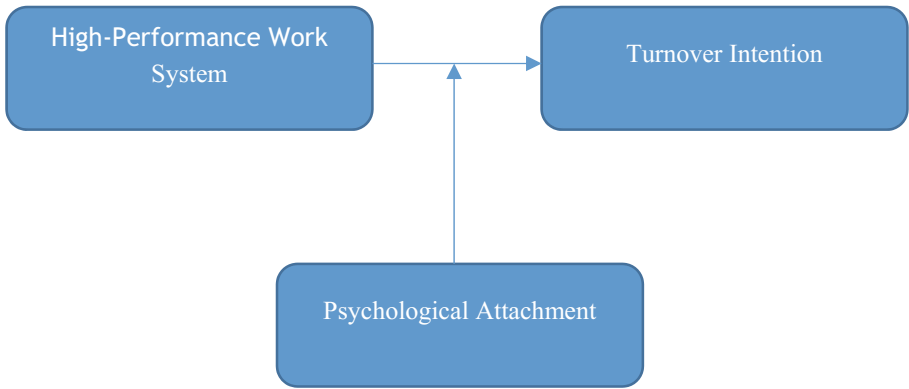


Fig. 2. Authors framework of moderating analysis

4 Discussion

In relation to the relationship between high performance work systems and turnover intention, the findings from this paper is consistent with the works of [32, 33], who proposed that high performance work systems are approaches to labor management characterized by participated forms of work, skills enhancement mechanisms to motivate employees. Therefore, if these propositions are not adopted organisations will

experience an increasing turnover intention. Additionally, [34] posit that, the intention to leave becomes eminent if elements of high-performance work systems do not encourage the autonomy of making one's own decision and motivation. High performance work systems generally give rise to positive impacts on employees by increasing job satisfaction and commitment [35]. Poor hiring practices, managerial style, lack of recognition, lack of competitive compensation system in the organization and toxic workplace environment may account for employee turnover [36]. Based on our findings, it can be concluded that an organization could experience high turnover when there is low performance work system. [37] advanced that for employees to reduce turnover intent they must be fully attached both emotionally and psychologically which is likely to spur greater motivation to uphold its values and speed the achievement of its objectives. Extant literature on high performance work systems indicates that it indeed predicts employee's psychological attachment level. [1, 35, 38] maintain that high performance work systems positively impact on employees by increasing their commitment at workplace. This in other words, means that if there is high performance work system in an organization where human resource practices are effectively executed to the satisfaction of employees and thereby increasing employee's psychological attachment to the organisation. Also, [39] stated that organizations that invest in high performance work systems programs will have more proficient employees, more participation and devoted to achieving organizational goals, which simply indicate that employees will be psychologically attached if high performance work systems are adapted. Training and development practices, which are also high performance systems, have a positive impact on employee [40] Training and development are undertaken in order to train employees to work more effectively, improve their technical skills, interpersonal skills, teamwork confidence and motivation to work, which will enable employees' commitment hence their attachment. As postulated by [41], both the organisation and employee benefit from training and development. Employees may share their acquisition of knowledge, skills and abilities needed to perform required jobs and also be ready to any development. On the side of the organisation, there is increase in productivity, employee loyal, commitment and decline in turnover intention. [42] mentioned that training and development helps organization to improve retention and reduce turnover. Therefore it is important to adopt significant systems that best fit for the employees and the organization as a whole to enhance commitment and reduce turnover.

The moderation analysis explains the effect of psychological attachment on turnover intention. As shown in the finding, the hypothesis that psychological attachment will moderate the relationship between high-performance work system and turnover intention is supported. The feeling of being psychologically attached to an organisation will reduce the turnover intent of those workers. Human resource strategies must provide employees with some level of job satisfaction and attachment [43, 44]. The availability of psychological attachment as a result of high performance work systems will however predict turnover intention in the Ghanaian banking sector.

The study has implications for management. Several decades ago, a new model was discussed by [45] to attract employees commitment and ultimately to increase organizational performance, known as the High Performance Work Systems. managers must be of the view that a true contribution of HRM is to motivate employees to work

harder and then bring them to stay within the organization as well. However, the message of HPWS lost its very reason because of fixation on financial performance among others. Findings from our study indicate the relevance of HPWS and its relationship with turnover intention. That high performance work systems must be seen as approaches to effective labor management largely underpinned by participatory work, discretionary decision making and mechanisms to enhance employees' skills, which will greatly reduce turnover intentions. Apparently, psychological attachment has a moderating ability to influence turnover, hence a strong employees' attachment practices must be endorsed in order to achieve a perfect attachment to the organizations thereby reducing turnover intentions and increasing commitment. This in other words, means that if there is a high performance work system in an organization, to the satisfaction of employees, consequently there will be an increase in psychological attachment to the organization. Thus managers must resolve to execute HPWS practices that sought to boost morale, have participatory employees interested in achieving organizational goals.

5 Conclusion

Even though the third model was not significant after the introduction of the interaction term, the model had a greater and wider proportion of variance in employee turnover as compared with the previous model without the inclusion of the interaction term. One important observation was an increment in the beta coefficient after including the interaction into the model. An indication that HPWS standing alone will not be enough to have that greater influence in employee turnover intention but an experience of psychological attachment as a result of HPWS will eventually reduce turnover intention among employees.

The paper argues that the practice of HPWS should be moved from management-centered and attention should rather be on how it impacts on employees and attitudes. As argued by [14] one of the major antecedents of employee's behavioural outcome is the management of HPWS in organisations. Management development of HPWS as a business strategy is not enough but rather add intrinsic value to the psychology of employees who collectively or individually contribute to the organisation. Human resource policies and practices must encourage participation so that individuals can be committed which will eventually lead to being psychologically attached to their respective organisations. The cost of losing employees is a big blow to organisations that seek to gain competitive advantage. Understanding the importance of this psychological attachment concept is critical for organisational success, employee development and competitive advantage strategy. Additionally, the Harvard model of human resource management stresses the need for linking human resource practices to the overall organisational strategy. The model posits that the efficiency and effectiveness of employees' commitment is directly linked to how human resource policies like HPWS are executed for the benefit of employees. These systems or practices are developed to win the heart and mind of employees and also for the realization of their relative worth in the organisation.

Linking HPWS to psychological attachment is critical as [43] argue that poor execution of HPWS has consequential effect on employees' work attitudes. HPWS as a component of SHRM includes provision of intensive training, information, motivation, employee involvement, establishing internal promotions based on merit as well as performance-based pay [4]. As suggested by the AMO theory, there are three independent work systems that shape employees behaviour and contribution to work. These systems are: (a) developing employee skills and competencies, (b) increasing motivation and (c) providing an avenue where those skills obtained can be put into full use and also ensuring some level of autonomy. Base on the AMO theory, the probability that an individual will be psychologically attached to an organisation is high when they are given intensive training, high level of autonomy and put learned skills into use. This however contribute to work attitude like job satisfaction, task performance and commitment.

References

1. Bashir, M., Jianqiao, L., Ghazanfar, F., Abrar, M.: The effect of perception of existence of HPWS on employee's organizational commitment: a test of social exchange relationship and contingency perspective to implement HPWS in universities of China and Pakistan. *J. Adv. Asian Soc. Sci.* **1**(1), 87–89 (2012)
2. Posthuma, R.A., Campion, M.C., Masimova, M., Campion, M.A.: A high performance work practices taxonomy: integrating the literature and directing future research. *J. Manag.* **39**(5), 1184–1220 (2013)
3. Jiang, K., Lepak, D., Hu, J., Baer, J.: How does human resource management influence organizational outcomes? A meta-analytic investigation of mediating mechanisms. *Acad. Manag. J.* **55**(6), 1264–1294 (2012)
4. Datta, D.K., Guthrie, J.P., Wright, P.M.: Human resource management and labor productivity: does industry matter. *Acad. Manag. J.* **48**(1), 135–145 (2005)
5. Wright, P.M., Dunford, B.B., Snell, S.A.: Human resources and the resource based view of the firm. *J. Manag.* **27**(6), 701–721 (2001)
6. Appelbaum, E., Bailey, T., Berg, P., Kalleberg, A.L.: *Manufacturing Advantage: Why High Performance Work Systems Pay Off*. Cornell University Press, New York (2000)
7. Delongis, A., Folkman, S., Lazarus, R.S.: The impact of family stress on health and mood: psychological and social resources as mediators. *J. Pers. Soc. Psychol.* **54**, 486–495 (1988)
8. Ganster, D.C., Schaubroeck, J.: Work stress and employee health. *J. Manag.* **17**, 235–271 (1991)
9. Zacharatos, A., Barling, J., Iverson, R.: High-performance work systems and occupational safety. *J. Appl. Psychol.* **90**(1), 77–93 (2005)
10. Ainsworth, M.D.S.: Attachment as related to mother-infant interaction. In: *Advances in the Study of Behavior*, vol. 9, pp. 1–51. Academic Press (1979)
11. Bowlby, J.: *Attachment. Attachment and Loss*. Basic Books, New York (1969)
12. Bretherton, I.: Attachment theory: retrospect and prospect. *Monogr. Soc. Res. Child Dev.* **50**, 3–35 (1985)
13. Guchait, P., Cho, S.: The impact of human resource management practices on intention to leave of employees in the service industry in India: the mediating role of organizational commitment. *Int. J. Hum. Resour. Manag.* **21**(8), 1228–1247 (2010)

14. Guthrie, J.P.: High-involvement work practices, turnover, and productivity: evidence from New Zealand. *Acad. Manag. J.* **44**(1), 180–190 (2001)
15. Tsai, C.J.: High performance work systems and organizational performance: an empirical study of Taiwan's semiconductor's design firms. *Int. J. Hum. Resour. Manag.* **17**(9), 1512–1530 (2006)
16. Chaudhuri, K.: An empirical quest for linkages between HPWS and employee behaviors—a perspective from the non managerial employees in Japanese organizations. *World Acad. Sci. Eng. Technol.* **53**, 621–635 (2009)
17. Boselie, P., Dietz, G., Boom, C.: Commonalities and contradictions in HRM and performance research. *Hum. Resour. Manag. J.* **15**(3), 67–94 (2005)
18. Combs, J., Liu, Y., Hall, A., Ketchen, D.: How much do high-performance work practices matter? A meta-analysis of their effects on organizational performance. *Pers. Psychol.* **59**(3), 501–528 (2006)
19. Cheng-Hua, T., Shyh-Jer, C., Shih-Chien, F.: Employment modes, high-performance work practices, and organizational performance in the hospitality industry. *Cornell Hosp. Q.* **50**(4), 413–431 (2009)
20. Macky, K., Boxall, P.: High-involvement work processes, work intensification and employee well-being: a study of New Zealand worker experiences. *Asia Pac. J. Hum. Resour.* **46**(1), 38–55 (2008)
21. Kuvaas, B., Dysvik, A.: Does best practice HRM only work for intrinsically motivated employees. *Int. J. Hum. Resour. Manag.* **21**(13), 2339–2357 (2010)
22. Lam, W., Chen, Z., Takeuchi, N.: Perceived human resource management practices and intention to leave of employees: the mediating role of organizational citizenship behaviour in a Sino-Japanese joint venture. *Int. J. Hum. Resour. Manag.* **20**(11), 2250–2270 (2009)
23. Boon, C., Den Hartog, D.N., Boselie, P., Paauwe, J.: The relationship between perceptions of HR practices and employee outcomes: examining the role of person–organization and person–job fit. *Int. J. Hum. Resour. Manag.* **22**(1), 138–162 (2011)
24. Alfes, K., Shantz, A.D., Truss, C., Soane, E.C.: The link between perceived human resource management practices, engagement and employee behavior: a moderated mediation model. *Int. J. Hum. Resour. Manag.* **24**(2), 330–351 (2012)
25. Kehoe, R., Wright, P.: The impact of high performance human resource practices on employees' attitudes and behaviors. *J. Manag.* **39**(2), 366–391 (2013)
26. Paauwe, J.: HRM and performance: achievements, methodological issues and prospects. *J. Manag. Stud.* **46**(1), 129–142 (2009)
27. Amankwaa, A., Anku-Tsede, O.: The moderating effect of alternative job opportunity on the transactional leadership–turnover intention nexus: evidence from the Ghanaian banking industry. *Afr. J. Bus. Manag.* **9**(14), 553–561 (2015)
28. Becker, B., Huselid, M.: High performance work systems and firm performance: a synthesis of research and managerial implications. *Res. Pers. Hum. Resour. Manag.* **16**, 53–101 (1998)
29. O'Reilly, C.: Chatman: organizational commitment and psychological attachment: The effects of compliance, identification, and internalization on prosocial behaviour. *J. Appl. Psychol.* **71**, 492–499 (1986)
30. Jackofsky, E.F., Slocum, T.W.: A causal analysis of the impact of job performance on the voluntary turnover process. *J. Occup. Behav.* **8**(3), 263–270 (1987)
31. Aiken, L.S., West, S.G.: *Multiple Regression: Testing and Interpreting Interactions*. Sage, Newbury Park, CA (1991)
32. Huselid, M.A.: The impact of HRM practices on turnover, productivity, and corporate performance. *Acad. Manag. J.* **38**(3), 635–672 (1995)

33. Van De Voorde, K., Beijer, S.: The role of employee HR attributions in the relationship between high performance work systems and employee outcomes. *Hum. Resour. Manag. J.* **25**(1), 62–78 (2015)
34. Guest, D.E.: Employee engagement: a sceptical analysis. *J. Organ. Effectiveness People Perform.* **1**(2), 141–156 (2014)
35. Jensen, J.M., Patel, P.C., Smith, J.G.: High-performance work systems and job control: consequences for anxiety, role overload, and turnover intentions. *J. Manag.* **39**(6), 1699–1724 (2013)
36. Barak, N.L.: Antecedents to retention and turnover among child welfare, social work and other human services employees: what can we learn from past research? A review and meta-analysis. *Soc. Serv. Rev.* **75**(4), 625–638 (2001)
37. Luchak, A.A.: What kind of voice do loyal employees use? *Br. J. Ind. Relat.* **41**(1), 115–134 (2003)
38. Lepine, J.A., Van Dyne, L.: Predicting voice behavior in work groups. *J. Appl. Psychol.* **83**(6), 853–868 (1998)
39. Shin, E.: Unions and the adoption of high-performance work systems in Korea: moderating roles of firms' competitive strategies. *Int. J. Hum. Resour. Manag.* **25**(13), 1858–1880 (2014)
40. Devi, V.R., Shaik, N.: Training and development—a jump starter for employee performance and organizational effectiveness. *Int. J. Soc. Sci. Interdisc. Res.* **1**(7), 2277–3630 (2012)
41. Jehanzeb, K., Bashir, N.A.: Training and development program and its benefits to employees and organizations: a conceptual study. *Far East J. Psychol. Bus.* **9**(2), 58–71 (2012)
42. Hassan, W., Razi, A., Qamar, R., Jaffir, R., Sohail, S.: The effect of training on employee retention. *Global J. Manag. Bus. Res. Adm. Manag.* **13**(6), 16–20 (2013)
43. Boxall, P., Macky, K.: Research and theory on high-performance work systems: progressing the high-involvement stream. *Hum. Resour. Manag. J.* **19**(1), 1–21 (2009)
44. Godard, J.: High performance and the transformation of work. The implications of alternative work practices for the experience and outcome of work. *Ind. Labor Relat. Rev.* **54**(4), 776–805 (2001)
45. Walton, R.E.: From control to commitment in the workplace. *Harvard Bus. Rev.* **63**(2), 77–84 (1985)



Constructing a Work Motivation Model Based on “Benefit Delay” and “Benefit Enjoyment”

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Abstract. We constructed a work motivation model for professional workers based on “benefit delay,” a key concept we created that represents the time gap between performing actions that produce benefits and their subsequent enjoyment. Labor can be regarded as the investment of production resources of a worker in the execution of their duties, and an opportunity to enjoy the benefit of improved professional competence. We conducted a questionnaire survey to clarify the effect of enjoyment and delay of benefits. The results of the survey showed that the improvement of professional workers’ competence depends on their experience gained through work; therefore, there can be a delay in enjoyment. If the result of investing their resources is delayed and unclear, work motivation may decline, and career changes will be encouraged. However, during a period when the functional benefits are delayed, “emotional benefit” and “perspective benefit” may function complementarily to generate work motivation.

Keywords: Work motivation · Benefit enjoyment · Benefit delay · Functional benefit · Emotional benefit · Perspective benefit

1 Introduction

In this paper, we address labor as a means of enjoying the benefit of personal growth and constructed a work motivation model for professional workers from the perspective of delayed enjoyment of benefits. The investigation was conducted on care workers in the nursing care service industry. The reason for this is because, despite the declining birthrate and aging population in Japan, there is a high turnover rate among care workers, especially among those with fewer years of experience. In 2017, 65.2% of employees who left the industry were employees with less than 3 years of service [1]. Thus, ensuring effective care for the elderly is a critical social issue in Japan.

To reduce the turnover rate among care workers and to effectively and efficiently improve the quality of nursing care services, we must concern ourselves with the maintenance and improvement of care workers’ motivation. We thus conducted an interview survey to find ways to contribute to care workers’ motivation. This interview survey was conducted with 35 staff members engaged in various types of work at five facilities operated by a company that provides housing for senior citizens in Japan (head office: Kagawa Prefecture).

In Japan, it is said that the nursing care service industry is a “3K” workplace (derived from the Japanese terms *kitsui* (hard), *kitanai* (dirty), and *kikken* (dangerous) or *kez-saishunyu ga hikui* (low pay)), but surprisingly, many survey respondents indicated that they were “happy” performing their work, or that it was “enjoyable.” This suggests that interaction with clients evokes positive emotions in care workers, which leads to the creation and strengthening of intrinsic motivation. Furthermore, the survey data indicated that one cause of the high turnover rate was a delay in enjoying the benefits of personal growth, which suggests that it is difficult to recognize improvement in job skills in the care industry [2]. Interpreting this result as an opportunity, we attempted to construct a work motivation model that considers the enjoyment and delay of benefits.

2 Constructing a Work Motivation Model

2.1 Labor as a Means of Personal Growth

Labor can be regarded as the investment of production resources such as time, expert knowledge/skills, and mental/physical energy, among other things, of a worker in the execution of his/her duties, and the opportunity to enjoy the benefit of improved professional competence as compensation for resolving the issue to be addressed by the work. Maslow positioned the need for growth at the top of his five-level hierarchical model of human needs and assumed that humans who satisfy this need will continue to perform at a higher level of achievement [3]. However, it is easier to set the improvement of one’s own professional skills as a target, especially in the case of professional workers.

Workers select and engage in a specific occupation because they want to satisfy a fundamental need through the execution of their professional duties. For example, selecting and working in the medical profession may stem from the fundamental need to protect the precious lives of human beings. The worker satisfies the fundamental need that motivated the selection of their occupation through the execution of their professional duties, but in the process, it is possible to satisfy various other needs. For example, this includes the need for stability and improvement in lifestyle, personal growth, and earning the respect and esteem of others. Such a variety of needs are incidentally satisfied in the process of satisfying the fundamental need, but in the case of professional workers, personal and professional growth related to the execution of duties is an especially high priority. This is because improving professional skills related to the execution of one’s duties plays an important role in more efficiently and effectively carrying out activities to satisfy the fundamental need that formed the motivation for the selection of the occupation in the first place.

2.2 Three Benefits Enjoyed Through Labor and Their Delays

It is thought that enjoying the benefits of improving one’s professional competence through the execution of duties plays an important role in maintaining and improving the work motivation of professional workers and preventing them from changing careers, but since this benefit can only be enjoyed through accumulated work

experience, a benefit delay exists. Benefit delay is a concept we created to model client satisfaction and client participation in medical and educational services. It represents the difference between the point in time when activities are undertaken to create the benefits that clients want and the point in time when the client can enjoy the benefits as a result. We also assume that the degree of delay is highly dependent on the target level of the client [4]. Since a benefit delay is a phenomenon that occurs with respect to benefits that lead to positive changes in the client’s physical health, competence, values, and emotions, it can be applied to benefits that lead to positive changes in workers’ professional competence regarding the execution of their duties.

More broadly, benefit delay in labor can be defined as the time lag between when a worker carries out their work activities and the point when the positive changes in the worker’s health, skills, values, and emotions reach expected levels as a result of work activities.

As with benefit delay in service consumption, benefit delay in labor also poses various problems. Even if a worker invests his or her own production resources into satisfying the fundamental need, if professional competence only improves later and in an unclear form, work motivation will decrease and it is highly likely that the worker will opt to change careers. In addition, during the period in which a delay in the improvement of professional competence is occurring, the worker is unlikely to be able to sufficiently satisfy the needs of clients due to this lack of professional competence. In that case, the worker will receive negative feedback and complaints from clients, which will also be a factor in lowering his/her work motivation and prompting career change.

However, many professional workers maintain high work motivation and continue their duties for years. This phenomenon may be related to the fact that professional workers also enjoy other benefits through the execution of their duties, and these play a supplementary role in the period of delay in the improvement of professional competence. In other words, if we define improvement in professional competence as a “functional benefit,” there are also “emotional benefits” and “perspective benefits” that contribute to the maintenance and improvement of work motivation and prevent career change. Emotional benefits are a positive emotional state that is brought about by suppressing negative emotions evoked during the execution of duties and furthermore by the stimulation of positive emotions. For example, emotional benefits eliminate or reduce the negative emotion of anxiety that care workers often experience as they work alongside poor health and death in the execution of their duties. However, care workers can also experience positive emotions through the execution of their duties, such as “enjoyment” or “happiness” through their interactions with clients. Moreover, perspective benefits are a positive change in recognition, attitude, and importance (priority), among others, with respect to the fundamental need that motivated them to enter the profession and the needs arising in connection therewith, as well as a positive change in the direction of satisfying that need [2].

Among these three benefits, functional benefits followed by perspective benefits have the longest delay, while emotional benefits have the shortest. This is because emotions have a situation-dependent characteristic that varies easily according to events that occur while executing duties, whereas professional competence and values depend on the quality and quantity of work experience, lending them a cumulative nature. That is, the time required for accumulation determines the degree of delay.

2.3 Construction of a Work Motivation Model Based on Benefit Delay and Enjoyment

Work motivation is broadly divided into intrinsic and extrinsic motivation, and in the case of professional workers, intrinsic motivation tends to be the greater driver. This is because intrinsic motivation is derived from the work itself, and the typical rewards it targets are internal rewards such as feelings of achievement and personal and professional growth. Since professional workers have a fundamental need to contribute to solving social problems by dedicating themselves to their chosen profession, they are likely to be motivated by the work itself. Furthermore, by executing duties in search of satisfying such a fundamental need, they are rewarded by improving their own professional competence. Therefore, we focus on intrinsic motivation and consider the factors below to be influential. Based on the results of the abovementioned interview survey, it is possible to assume the model shown in Fig. 1.

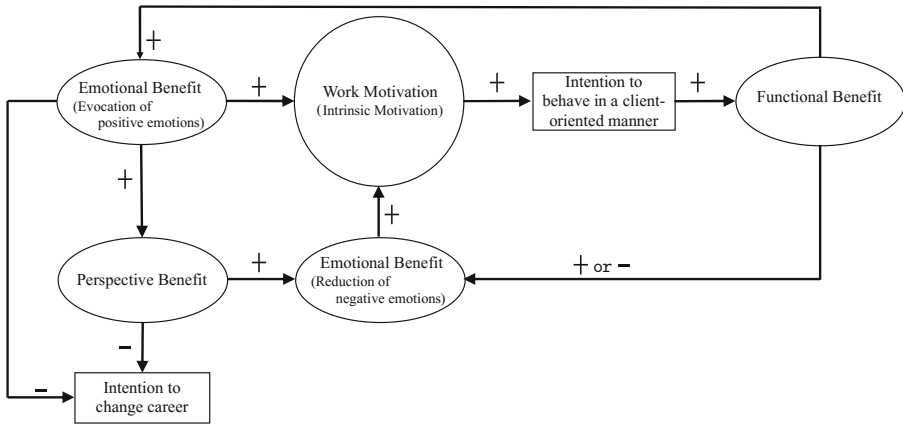


Fig. 1. Work motivation model based on enjoyment and delay of benefits

In this model, it is assumed that a virtuous cycle relationship is formed starting from the enjoyment of the emotional benefit of positive emotions evoked through carrying out work duties. That is, care workers enjoy the emotional benefit of the evocation of positive emotions such as “enjoyment” and “happiness” through interaction with clients, and it was assumed that this would affect the generation and enhancement of intrinsic motivation. Since the evocation of positive emotions also positively changes the perception of the importance of their duties and their attitude toward them, it was assumed that the enjoyment of the perspective benefit would also be affected. In addition, it was assumed that enjoyment of such a perspective benefit reduced negative emotions and promoted intrinsic motivation. The effect of the evocation of positive emotions and improving perception of work (perspective benefits) on work motivation was also clarified in a study of knowledge workers by Amabile and Kramer [5].

It was assumed that the intrinsic motivation generated and enhanced by such a process leads to client-oriented behavior, and the enjoyment of functional benefits, such as the improvement of professional competence in the process of accumulation of

experience in the execution of duties, is delayed. The execution of duties with improved professional competence means that clients can receive services that better meet their needs, and satisfaction and pleasure seem to be returned to care providers as a result. In addition, improved professional competence also has an impact on the reduction of negative emotions, but this effect was considered to have two contrary directions. The first direction promotes a reduction in negative emotions since improving professional competence enhances confidence in one’s ability to execute work duties. The second direction is an increase in the sense of anxiety and suppression of the reduction of negative emotions, because as professional competence improves, the factors that should be considered (or to which attention should be given) and available choices in the execution of duties expand, and the worker perceives greater risk. It is difficult to judge which effect will occur, so Fig. 1 displays the two diametrically opposed effects.

In addition, it was considered that evocation of positive emotions and perspective benefits helped to reduce the desire to change careers. This is because the intention to continue executing one’s duties may be enhanced by recognizing their enjoyableness and social importance.

3 Methods

To verify the work motivation model based on the enjoyment and delay of benefits as shown in Fig. 1, we conducted a questionnaire survey on workers at serviced homes for senior citizens.

Table 1. Characteristics of care workers analyzed

Sex	n	(%)	Employment status	n	(%)
Male	29	(12.5)	Full-time	133	(57.3)
Female	202	(87.1)	Part-time	98	(42.2)
No response	1	(0.4)	No response	1	(0.4)
Age	n	(%)	Years of experience in care work	n	(%)
20–29	31	(13.4)	Under 3 years	45	(19.4)
30–39	63	(27.2)	3–5 years	44	(19.0)
40–49	60	(25.9)	5–10 years	71	(30.6)
50–59	43	(18.5)	10–15 years	40	(17.2)
Over 60	14	(6.0)	15+ years	12	(5.2)
No response	21	(9.1)	No response	20	(8.6)

The questionnaire survey was conducted during the period of August 22 to September 23, 2016 with workers (639 people) engaged in the 28 facilities of a company that cooperated with the abovementioned interview survey. The survey method was conducted by distributing and collecting questionnaires by mail. The number of valid responses was 439, consisting of facility managers/deputy facility managers (19), care managers (14), administrators (22), nurses/physical therapists/occupational therapists (79), service provision managers (11), care workers (232), administrative staff members (16), and other/unknown (46).

Since various occupations are included in the valid responses, and the professional competences required by the job types are different, the care workers, for which there was the largest number of valid responses, were made the target of the analysis. Table 1 shows the characteristics of the 232 care workers whose responses were analyzed.

4 Results and Discussion

4.1 Specification of Question Items for Measuring Concepts in the Model

Factor analysis for extraction of benefits, intrinsic motivation, and intention to behave in a specific manner was carried out using the maximum likelihood method/promax rotation on the question items for measuring the model concepts shown in Fig. 1. In the factor analysis, the following criteria were set for deletion of question items: (1) commonality less than 0.40, (2) factor loading less than 0.35, and (3) factor loading of 0.35 or more for two or more factors.

Table 2 shows the summarized results of extracted factors (concepts), the Cronbach's α calculated to examine internal consistency, and averages of question items (scores) showing the high factor loadings for each item. As functional benefits, two cases were extracted: improvement of situation response capability and improvement of interpersonal skills. Two emotional benefits were also extracted: evocation of positive emotions and reduction of negative emotions. Additionally, change in perspective on work was extracted as a perspective benefit.

Table 3 displays the relationship coefficients calculated using the score of each factor (concept) extracted in Table 2. As evocation of positive emotion shows a relatively high relationship with all factors, it is assumed that it plays a particularly important role in the work motivation model for care workers. There is also a relatively high relationship between intrinsic motivation and client-oriented behavior.

Table 2. Extracted elements (concepts) and descriptive statistics for question items

	Concept	Variable	Question item	Each question item Average (SD)	Cronbach α	Score for each factor Average (SD)		
Functional Benefit	Improvement of situation response capability	B1	I am becoming able to respond more smoothly to clients (residents) than before	3.97 (0.88)	0.709	3.83 (0.75)		
		B2	I am becoming able to respond according to my own judgment more than before	3.68 (0.83)				
	Improvement of interpersonal skills	B3	I have become able to respond to the rejection of clients more appropriately than before	3.58 (0.81)				
		B4	I am becoming more able to control my behavior and language properly in interactions with others than before	3.52 (0.81)				
		B5	Through my work, I am becoming able to respond more appropriately, taking into consideration the situation of the other party	3.55 (0.76)				
Emotional Benefit	Evocation of positive emotions	B6	I often feel 'happy' due to gratitude expressed by the clients	3.94 (0.85)	0.806	3.69 (0.72)		
		B7	I feel 'enjoyment' through conversation with the clients more often than before	3.50 (0.98)				
		B8	I have come to feel fulfillment in helping or assisting other people	3.63 (0.86)				
		B9	I am coming to understand the social importance of my work more than before	3.68 (0.91)				
	Reduction of negative emotions	B10	My work-related stress is much lower than before	2.51 (1.22)			0.835	2.71 (1.04)
		B11	The mental burden of my work is much lighter than before	2.71 (1.16)				
B12	My anxiety concerning human relationships in the workplace is much lower than before	2.91 (1.23)						
Perspective Benefit	Change in perspective on work	B13	My way of thinking about nursing care service is changing in a good way	3.15 (0.95)	0.83	3.27 (0.90)		
		B14	My way of thinking about my job is changing in a good way through my work	3.39 (0.98)				
Work Motivation	Intrinsic motivation	M1	I like my current work	3.55 (1.14)	0.909	3.37 (0.95)		
		M2	I am deeply pleased with my current work	3.26 (1.03)				
		M3	I am proud of my current work	3.72 (1.04)				
		M4	My current work gives me purpose	2.97 (1.15)				
		M5	Currently, I enjoy working	3.40 (1.16)				
Intention to behave in some manner	Intent to behave in a client-oriented manner	D1	I work with a focus on clients	3.63 (0.89)	0.895	3.48 (0.66)		
		D2	I connect with clients everyday, like family	3.31 (0.94)				
		D3	I give priority to the convenience of clients rather my own convenience	3.36 (0.89)				
		D4	It doesn't matter if my workload is heavy, as long as I can help or assist other people	2.93 (1.08)				
		D5	I always provide the most appropriate service to each client	3.41 (0.80)				
		D6	I am happy to make more effort than most for the sake of the clients	3.68 (0.91)				
		D7	I always provide services with an understanding of the situation of clients	3.74 (0.77)				
		D8	I do my best to help clients have enjoyable daily lives	4.05 (0.87)				
		D9	It is my task to think of ways to provide better services to clients	3.26 (0.91)				
	Intention to change career	D10	I often think that changing to a job in a different field from nursing care services would be better for my personal growth	2.62 (1.16)			0.770	2.68 (1.00)
		D11	Changing to a job in a different field from nursing care services would be better for my career development	2.75 (1.06)				

Table 3. Relationship between concepts in the model

	Improvement of situation response capability	Improvement of interpersonal skills	Evocation of positive emotions	Reduction of negative emotions	Change in perspective on work	Intrinsic motivation	Intention to behave in a client-oriented manner	Intention to change career
Improvement of situation response capability	1.000	0.395 ***	0.395 ***	0.166 *	0.371 ***	0.308 ***	0.329 ***	-0.090
Improvement of interpersonal skills		1.000	0.579 ***	0.274 ***	0.523 ***	0.373 ***	0.589 ***	-0.178 **
Evocation of positive emotions			1.000	0.468 ***	0.689 ***	0.706 ***	0.721 ***	-0.180 **
Reduction of negative emotions				1.000	0.620 **	0.550 ***	0.358 ***	-0.160 *
Change in perspective on work					1.000	0.630 ***	0.551 ***	-0.170 **
Intrinsic motivation						1.000	0.639 ***	-0.281 **
Intention to behave in a client-oriented manner							1.000	-0.168 *
Intention to change career								1.000

***p < 0.001, **p < 0.01, *p < 0.1

4.2 Delay Differences in Enjoying the Five Extracted Benefits

First, we examined the degree of delay in the enjoyment of each of the five benefits. Figure 2 provides the results concerning how the care workers' enjoyment of each benefit changed as their years of work experience increased. The rate of care workers who perceived enjoyment of a benefit is the proportion of care workers whose average (score) for each benefit calculated above exceeded 3.00.

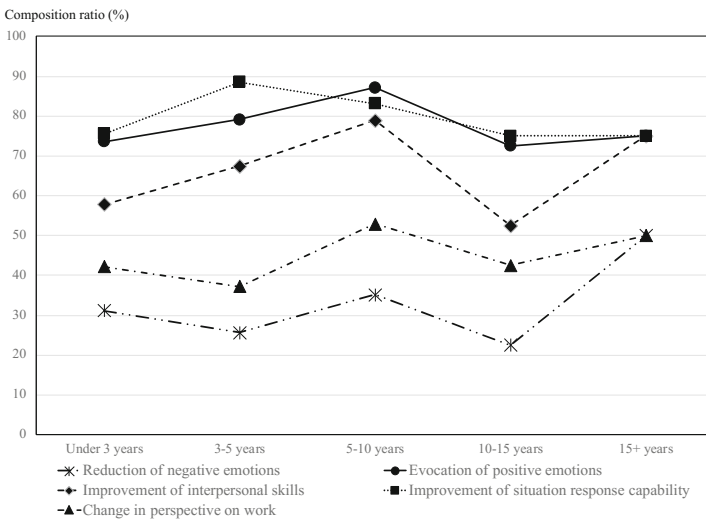


Fig. 2. Change in enjoyment of benefits according to years of experience in care work

The rate of enjoyment of benefits other than the improvement of situation response capability and the reduction of negative emotions was the highest in the 5 to 10 years strata and tended to decline in the 10 to 15 years strata. It is assumed that the degree of delay is relatively small for the improvement of situation response capability, as the rate of enjoyment was the highest in the 3 to 5 years strata. Meanwhile, the rate of enjoyment of reduction of negative emotions was the highest in the 15+ years strata, but we believe that the degree of delay is the largest because not even half of the care workers had enjoyed it. In addition, the degree of delay in the change in perspective on work seems to be relatively large, since the rate of enjoyment was about half, even in the 5 to 10 years strata and the 15+ years strata, which had high rates of enjoyment.

4.3 Differences in Intrinsic Motivation and Intention to Behave in a Certain Manner Due to the Enjoyment Situation of the Three Benefits

Table 4 shows the results of classifying care workers according to the three patterns of enjoying benefits and comparing the average (scores) of intrinsic motivation, intention to behave in a client-oriented manner, and intention to change career. A benefit was determined to be enjoyed if the score of the benefit exceeded 3.00, and to not be enjoyed if it was 3.00 or less. Furthermore, the reason that improvement of interpersonal skills was used as a functional benefit and evocation of positive emotion as an emotional benefit was because there was a relatively high correlation between these factors and intrinsic motivation, intention to behave in a client-oriented manner, and intention to change career in the relationship analysis displayed in Table 2.

Pattern 1 (3.97) has the highest score (average value) for intrinsic motivation, and it is a strata of care workers who enjoyed all three benefits. The next highest was Pattern 5 (3.68) followed by Pattern 2 (3.28), and the emotional benefit of evocation of positive emotions was enjoyed in all three patterns. As indicated by the relationship analysis shown in Table 2, it was surmised that the evocation of positive emotion plays the most important role in the generation and enhancement of intrinsic motivation.

Pattern 1 (3.89) had the highest score (average value) for intention to behave in a client-oriented manner, followed by Pattern 2 (3.60), Pattern 3 (3.44), and Pattern 5 (3.42). Since the intention to behave in a client-oriented manner scored high in the patterns in which the emotional benefit of evocation of positive emotions is enjoyed, it is presumed that evocation of positive emotion also plays an important role in the intention to behave in a client-oriented manner. However, looking at Pattern 6, in which only the emotional benefit is received, the intention to behave in a client-oriented manner is the third (3.11) score (average value) from the bottom; therefore, it seems that emotional benefits alone do not possess sufficient impetus to prompt client-oriented behavior.

Regarding intention to change career, apart from Pattern 7 and Pattern 3, which had small sample counts, Pattern 1 (2.43) had the lowest score (average value), followed by Pattern 4 (2.45), and Pattern 5 (2.75). This suggests that perspective benefit plays an important role in reducing the intention to change careers, because the enjoyment of the perspective benefit of change in perspective on work is common to these three patterns. This trend supports the direct suppression effect of perspective benefit on intention to change jobs in Fig. 1.

Table 4. Differences in internal motivation and intention to act due to benefit enjoyment pattern

Benefit enjoyment pattern				Intrinsic motivation		Intention to behave in a client-oriented manner		Intention to change career	
Pattern	Functional benefit	Emotional benefit	Perspective benefit	Average (SD)	Frequency	Average (SD)	Frequency	Average (SD)	Frequency
	Improvement of interpersonal skills	Evocation of positive emotions	Change in perspective on work						
1	○	○	○	3.97 (0.75)	86	3.89 (0.54)	87	2.43 (1.08)	88
2	○	○	×	3.28 (0.74)	50	3.60 (0.54)	48	2.79 (0.96)	50
3	○	×	○	2.70 (0.42)	2	3.44 (0.47)	2	2.75 (0.35)	2
4	○	×	×	2.47 (1.19)	11	2.69 (0.64)	9	2.45 (0.61)	11
5	×	○	○	3.68 (0.79)	12	3.42 (0.40)	12	2.75 (0.87)	12
6	×	○	×	3.01 (0.71)	32	3.11 (0.47)	31	2.97 (0.96)	32
7	×	×	○	3.00 (-)	1	3.11 (-)	1	2.00 (-)	1
8	×	×	×	2.61 (0.91)	33	2.86 (0.56)	33	2.97 (0.98)	33
Total				3.38 (0.95)	227	3.48 (0.66)	223	2.68 (1.00)	229
F-test amount				14.826***		19.211***		1.860*	

1) '○' indicates the benefit is enjoyed, '×' indicates it is not.

2) *** p < 0.001, * p < 0.1

4.4 Validation of the Constructed Work Motivation Model

We validated the work motivation model using structural equation modeling. The factors extracted by factor analysis and question items showing high loadings for each factor were used as latent variables. However, observation variables for measuring each latent variable were limited to the top four items.

Figure 3 displays the results of the covariance structure analysis and shows only statistically significant relationships. The values of GFI, AGFI, CFI, AIC, and RMSEA for evaluating the fitness of the model are the results of recalculation excluding the causal relationships for which no statistically significant relationship was found.

In the relationships between the factors assumed in the work motivation model of Fig. 1, the following three relations were statistically unsupported: a direct suppression effect of the evocation of positive emotion on the intention to change career, and a direct effect of improvement of situation response capability on the evocation of positive emotion and on the reduction of negative emotions. However, as the improvement of situation response capability was found to have a direct influence on the improvement of interpersonal skills, it indirectly influences the evocation of positive emotions and the reduction of negative emotions.

Both a promoting effect and a suppressing effect were considered for the effect of the improvement of interpersonal skills on the reduction of negative emotions, but the analysis results revealed the tendency for negative emotions to be easily evoked as interpersonal skills improve. Such a relationship suggests that improving professional competence improves perception, and as a result, care workers become more aware of various factors that lead to anxiety and stress. This relationship is not necessarily a bad trend, because it will lead to care workers perceiving dangers and risks in the daily lives of the clients and taking actions to reduce them.

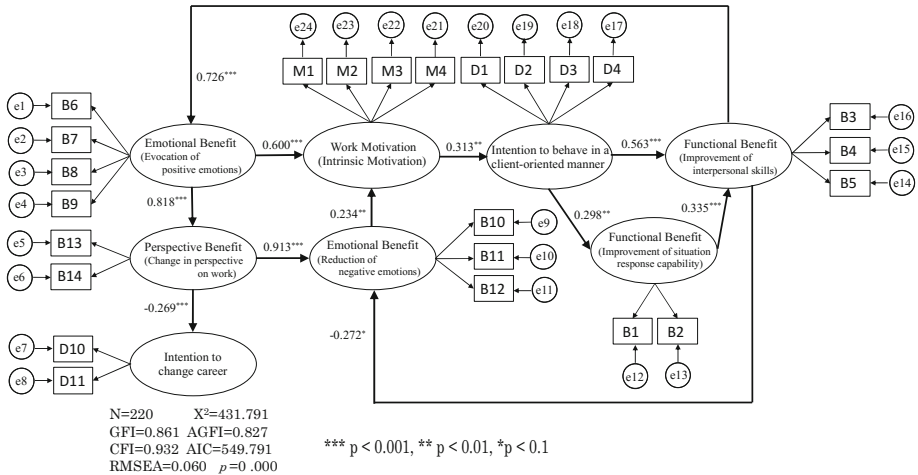


Fig. 3. Validation results for the constructed work motivation model

As a result of the verification, it is clear that the degree of delay is relatively small, the evocation of positive emotions forms a foundation for intrinsic motivation and work to generate and strengthen it, and intrinsic motivation leads to the intention to behave in a client-oriented manner. It has become clear that evocation of positive emotions also indirectly affects intrinsic motivation through the enjoyment of perspective benefits and the reduction of negative emotions. However, as demonstrated in Fig. 2, this indirect effect occurs only in a delayed manner because the degree of delay is relatively large for the change in perspective on work and the reduction of negative emotions. In addition, it has become clear that accumulating experience through client-oriented behavior leads to professional competence, and there is a virtuous cycle relationship by which such improvement in capability promotes the evocation of positive emotions.

Although the turnover rate is high in the nursing care service industry, the relationship whereby the intention to change career is suppressed by promoting enjoyment of perspective benefits through evocation of positive emotions is also supported. However, since a relatively large delay exists in enjoying the perspective benefit of change in perspective on work, workers may opt to change career during the period of the delay, leading to many workers leaving the profession within their first 3 years.

5 Conclusion and Future Study

Clearly the interaction between clients and care workers in the delivery process of nursing care services evokes positive emotions and thereby leads to the improvement of intrinsic motivation, client-oriented behavior, and professional competence. In addition, since improving professional competence improves support for clients, it was clear that care workers create environments that tend to evoke positive emotions in themselves and contribute to the formation of virtuous cycle relationships. On the basis of these results, creating a work environment that facilitates the evocation of positive emotions in professional workers and establishing a structure to support the improvement of professional competence through accumulating experience may facilitate improvement of service quality and client satisfaction.

It was also found that it is possible to suppress the intention to change career through the enjoyment of perspective benefits through the evocation of positive emotions. This result illustrates one direction in measures to improve the high turnover rate in the nursing care service industry.

As mentioned above, it is possible to consider work motivation from the perspective of enjoyment of positive change in the professional workers themselves and in the delay of such enjoyment, and this is expected to be a new approach. However, since the level of expertise and skills required of the care workers who are the subjects of analysis in this paper was lower than that of other professional workers, the investigation into whether the constructed work motivation model that considers the enjoyment and delay of benefits applies to other professional workers is left as a future research task. In the future, we will empirically verify the work motivation model that we constructed and verified in this paper with other professional workers who are required to have different levels of professional competence in the execution of their duties, with the aim of constructing a more broadly applicable model.

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References

1. Care Work Foundation: 2017 Survey on Health Care Labor Conditions. Care Work Foundation (2018)
2. Fujimura, K.: Attempting to build the work motivation model of the staffs of the care service industry by introducing “benefit enjoyment” and “benefit delay” as key concepts. *Kagawa Univ. Econ. Rev.* **89**(1), 15–85 (2016)
3. Maslow, A.H.: *Motivation and Personality*. Harper & Row, New York (1954)
4. Fujimura, K.: The negative effect that benefit delay in service consumption causes to a customer and the countermeasure against it. In: *Advances in The Human Side of Service Engineering, Proceedings of the AHFE 2017*, pp. 203–214. Springer (2017)
5. Amabile, T.M., Kramer, S.J.: Inner work life: understanding the subtext of business performance. *Harv. Bus. Rev.* **85**(5), 72–83 (2007)



A Leadership and Demographic View of the Nexus Between Emotional Intelligence and Job Satisfaction in Ghana's Banking Sector

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Abstract. The paper examines the relationship between emotional intelligence and job satisfaction levels of employees in the Ghanaian banking sector and whether the relationship is moderated by the transformational and transactional leadership styles. It also examines the influence of some demographic variables (age and educational levels) on the relationship. A cross-sectional design was used with standardized questionnaires to collect data. Both the simple random sampling and purposive sampling techniques were adopted to select respondents. 208 bankers was engaged in the study. The results indicated a positive relationship between bankers' emotional intelligence and their job satisfaction ($\beta = .02$, $p = .38$) although not statistically significant. However, transactional leadership ($\beta = .18$, $p = .04$) and transformational leadership ($\beta = .17$, $p = .02$) significantly moderated the relationship. The study shows the importance of leadership styles in facilitating job satisfaction among bankers and also reveals that age and high educational qualifications are not yardsticks for one's level of emotional intelligence.

Keywords: Emotional intelligence (EI) · Job satisfaction (JS) · Transformational leadership · Transactional leadership · Ghana

1 Introduction

The recent competition in the Ghanaian banking industry has promoted a lot of technical innovations, strategic customer service as well as created novel ways of handling capital resources, human resource and the entire banking atmosphere [1, 2]. The need for banks to improve the quality of products or services and keeping along with the global and local trends of doing business cannot be overemphasized. Banks engage in these activities so they lose out of a competitive market [3]. In the quest to maintain a favorable position in the banking industry, management must be able to frequently restructure its ways of creating, establishing and maintaining business relationships [2, 3]. Apart from these, there is the need to create conducive working environment and boost workers' satisfaction. This brings to light some important factors like emotional intelligence, leadership and job satisfaction for consideration in this Industry.

It is said that every form of learning has an emotional basis and emotions of people cannot be separated from organizational settings. According to Anand [4] leadership simply constitute the ability of a person or an organization to direct, guide and shape other individuals and group towards some goals and targets. In everyday life, people are influenced or assume leadership roles in one way or the other (either being led or leading others). These variables are also noted to have a link with job satisfaction of employees [5, 6]. Job satisfaction or dissatisfaction occurs as a result of the complex emotional reactions held towards one's job. According to Locke [7], it is a pleasurable emotional state from appraising one's job as satisfying.

Empirical studies and existing literature show that, the success of most managers and employees in the workplace depends to a large extent on their level of emotional intelligence in the work place [8, 9] among other factors. In other words, apart from qualities like academic intelligence, intelligent quotient and technical know-how, the manager and employee alike must have high emotional competence [10]. This is a quality when possessed helps to rightly appraise and judge stressful and unfavorable situations and deal positively with it [11, 12]. This is a powerful resource in business leadership. It is asserted that for one to achieve effective leadership, emotional intelligence constitutes about 85% whiles IQ forms only 15% [10, 13].

1.1 Rationale for the Study and Research Questions

There are countless empirical evidences supporting the predictive relationship between EI and leadership styles [5, 9, 10, 14–17] There are also studies supporting the relationship between EI and Job satisfaction and other positive work outcomes like altruistic behavior, organizational citizenship behavior, work performance [12, 18]. Research has established positive associations between emotional intelligence and job satisfaction of both workers and managers but it appears not much has been done on examining these three variables together (i.e. emotional intelligence, leadership styles and job satisfaction). Based on this, these research questions are asked:

- (i) What could be the moderating role or links of leadership styles to the relationship between emotional intelligence and job satisfaction?
- (ii) Could certain demographic variables such as gender, age and years of leadership experience affect the relationship between employees' emotional intelligence (EI) and Job satisfaction (JS)?

These are the questions the paper sought to answer.

2 Literature Review

2.1 Emotional Intelligence

Wechsler [19] defines general intelligence as the aggregate or global capacity of the individual to act purposefully, to think rationally, and to deal effectively with his or her environment. Wechsler's definition seems to portray what is widely considered as intelligence [20]. Intelligence has however been broadly categorized into 3 broad areas in

research. These are abstract, mechanical and social intelligence. The third division of intelligence (social intelligence) is sub-divided into motivational intelligence and emotional intelligence [9, 14]. The present study thus sort to concentrate on emotional intelligence since it has proven to account for 85% of success for effective workers [10, 13]. Emotional intelligence has mostly been named by its proponents including intrapersonal intelligence by Gardner [21] and emotional creativity by Averill and Thomas-Knowles [22]. Emotional intelligence in time past was hardly studied because it seemed the most difficult of the three broad categories of intelligence. The first published work on emotional intelligence was by Salovey and Mayer [23, 24]. Further works were published by Goleman [25]. Goleman is considered as one who popularized the idea of EI in his time [17].

According to Alston, Dastoor and Sosa Fey [14] emotions are reactions that are structured psychological, physiological, cognitive and motivationally based. Emotional reactions normally come up as a response to both external and internal events which may have negative or positive connotations to the individual and significant others.

There are two broad bases on which EI is popularly defined. It is either defined as a trait (an innate characteristic that promotes wellbeing) or ability (a competence). Due to the differences in conception, understanding and definition of EI, researchers have developed several instruments to measure the construct based on how it is conceptualized as either 'an ability' or 'a trait'.

Emotional intelligence has been defined as "the ability of a person to express emotions, assimilate emotion thoughts to understand and judge with the help of emotions and to also regulate one's own emotions and that of others." This definition is mostly given by American psychologist and Educational psychology teachers like John D. Mayer and Peter Salovey [26].

Another definition by Mayer and colleagues is the capacity to reason about emotions, and of emotions to enhance thinking. It includes the abilities to accurately perceive emotions, to access and generate emotions so as to assist thought, to understand emotions and emotional knowledge, and to reflectively regulate emotions so as to promote emotional and intellectual growth [13, 27]. Goleman [28] also defines it as "abilities such as being able to motivate oneself and persist in the face of frustrations; to control impulse and delay gratification; to regulate one's moods and keep distress from swamping the ability to think; to empathize and to hope" [29].

2.2 Leadership

Over the years in literature, scholars have found the subject of leadership hard to define. There have been so many theories developed to explain the concept of leadership and its dynamic nature [30]. Over time, several debates have risen among scholars about the subject of leadership and its various facets. Leadership is broadly said to be state of mind that begins with a desire to capitalize on employees' actions positively to attain goals set. Leadership is a vital factor to organizational success or failure [31] and leadership effectiveness [32]. A leader creates a supporting environment for followers or subordinates to contribute positively to organizational success. According to Humphrey [33], leadership is defined as a process of social interaction where performance outcomes are strongly influenced by the leader's ability to influence the behavior of their followers.

2.2.1 Transformational Leaders

Transformational leaders as the term suggests influence the values and needs to improve accomplishments of the followers. It is a leadership style geared towards changing of one's beliefs, values and attitudes in order to align to the collective goals of an organization. The concept is a component of the Bass and Avolio's full range leadership theory which has been extensively researched in the leadership field [17]. Transformational leadership is seen to be the ideal type of leadership that makes use of both individual and holistic strategies to meet a group's collective goal [30]. It upholds and encourages the unique contributions of individuals to the ultimate goals of the organization. Bass [34] posits that transformational leaders are ones who are not only interested in the progress and development of their followers but they spur growth in self-development and higher success levels in members. Such leaders are enthusiastic, optimistic and encourage commitment and loyalty to the group. They are committed to stimulate the minds of their followers positively and to do things beyond the status quo.

This type of leadership has four major elements: idealized influence, inspirational motivation, intellectual stimulation and individualized consideration [35]. *Idealized influence* constitutes the ability of leader to act as role model, willingness to take risks and follow a set of core values, convictions and principles by the leader's actions. *Inspirational motivation* also is the ability to inspire confidence and a sense of purpose in followers. Here, the leader is expected to have a clear vision and communicate effectively and precisely with followers as well as show commitment to set goals. *Intellectual stimulation* also refers to how the leader involves followers in decision making by stimulating them to be creative and innovative in seeking solutions to problems. The leader challenges the followers to think 'outside the box'. *Individualized Consideration* is the ability of the leader to recognize and consider the individual needs and desire of followers; to know what motivates each individual and capitalize on it to obtain the best from each follower.

2.2.2 Transactional Leadership

Transactional leadership on the other hand is one that gives the follower rewards and benefits for obeying the leader and complying with the leader's requests [31]. Leaders in this case are more task and goals directed but are less people-conscious. This type of leadership allows team members to make their own decisions, avoiding interference from the leader. The leader only steps in when a problem arises. There is also less interactive contact between the parties involved. This style of leadership is further divided into contingency reward and management by exception (active and passive) according to Bass [31]. When the hard work and good acts of followers are rewarded from time to time, it is termed contingent reward. Management by exception can be active or passive. With management by exception (active), leaders pay particular attention to followers and ensure that they comply with organizational laid down rules and procedures. Here, there is frequent interactions to monitor and offer assistance to employees if need be. Passive management by exception on the other hand offers subordinates freedom and 'breathing space'. The leader only intervenes when errors or total deviations spring up. For the current study, transactional and transformational leadership shall be explored.

2.3 Job Satisfaction

Job satisfaction is generally recognized as a multifaceted construct that includes employee feelings about different intrinsic and extrinsic job elements. It constitutes specific aspects of satisfaction related to pay, benefits, supervision, promotion, work conditions, organizational practices and interpersonal relationships [36]. There are complex emotional reactions people have towards the jobs. According to Locke [7] job satisfaction is the pleasurable emotional state that results from appraisal of a job as achieving or facilitating a person's values [7] cited in [37]. In other words, it refers to the attitude people have about their jobs. Job satisfaction involves employees' affective reaction to a job based on comparing actual outcomes to the desired outcomes from the job [38].

Studies has revealed that employees who are emotionally intelligent has high job satisfaction levels because they have good sense of appraising as well as regulating their own emotions in situations as compared to those that are less emotionally intelligent. Highly emotionally intelligent employees are quicker to identify the sources of their stress and frustration and better equipped to reduce and regulate such unpleasant situations they face [39]. Again, employees with high emotional intelligence experience high job satisfaction especially in groups because they use such skills to create positive vibes which in the end boost their wellbeing as well as the group [40]. Sy, Tram and O'Hara [12] assert that employees who are highly emotionally intelligent have high job satisfaction levels. Wong and Law [6] had similar results for their study. Managers with high EI show altruistic behaviors and this mostly ignite positive work behaviors at the workplace [5]. This also has a rippling effect on employees' job satisfaction and performance [6].

2.4 Emotional Intelligence, Leadership Styles and Job Satisfaction: The Nexus

Emotional intelligence is among some of the factors that significantly influence the effectiveness of organizations [18]; it helps in areas such as decision making, motivation, interpersonal relationships, and teamwork, maintaining talented people in organizations and job satisfaction as well as quality of work life [18]. Emotionally intelligent individuals in organizations are the ones who are able to regulate activities in the organization in order to effectively attain organizational objectives [11, 41]. 98% of "top performers" have high emotional intelligence quotient [39]. There are some empirical research works on Emotional intelligence (EI) and its associations with transformational leadership styles [5, 9, 14, 15]. After conducting a study on high profile business leaders, it was concluded that each of them demonstrated the four corner stones of EI which are emotional literacy, emotional fitness, emotional depth and emotional alchemy. Dartey-Baah and Mekpor [29] in their work in the Ghanaian Banking Sector noted that leaders' EI positively predicted employees' willingness to engage in organizational citizenship behavior. Similarly, Barling et al. [16] compared the self-report of managers' EI and their subordinates rating of their transformational leadership. The results showed that EI was positively associated with these aspects of transformational leadership (idealized influence, inspirational motivation and

individualized consideration). Higgs and Aitken [42] also concluded after studying the EI of 40 managers that because EI relates to a number of aspects of leadership, it could be a good predictor of leadership potential.

Work performance and productivity in organizations are significantly affected by the manager or leader's ability to manage emotions in the process of getting work done. The leader must transmit positive emotions, energy and enthusiasm in all situations. It is a key requirement in recent times to hire managers and employees with high emotional intelligence. It involves having a sense of self awareness, being highly motivated and also able to motivate others, appropriate adjustments of attitudes and developing empathetic skills [4]. Mandell and Pherwani [9] studied the predictive relationship between emotional intelligence and transformational leadership style of leadership among 32 managers working for a medium to large organization in the U.S. and found a significantly positive relationship between the variables.

A meta-analysis conducted by Harms and Crede [17] showed that there is a positive association between EI and transformational leadership. Also, EI had strong positive associations with the contingent reward aspect of transactional leadership. However, EI had negative associations with passive management by exception (an aspect of transactional leadership) - [43]. Additionally, Harms and Crede [17] reported in their literature reviews of the meta-analysis that positive associations has been found between EI and school and work performance among students and workers respectively as well as mental health. Morrison [10] found transformational leadership styles to be predictive of effective leadership and studies have also shown a positive relationship between effective leadership and high emotional intelligence. Though there are countless studies that have empirically tested the predictive relationship between EI and Transformational leadership and effective leadership, critics of emotional intelligence have labeled it to be an overstatement of facts [44–47]. Sadri [13] reviewed literature on emotional intelligence and leadership and concluded the paper by making recommendations based on studies reviewed as to how to incorporate emotional intelligence in leadership development programs [48]. Sadri argues that leadership can be made comprehensible, easy and effective when the concept of emotional intelligence is appropriately incorporated into leadership development programs.

The relationship between emotional intelligence and positive work outcomes like organizational citizenship behavior has also been examined. Organizational citizenship behavior (OCB) is an extra-role behavior aside what is formally required [49]. The role emotional intelligence plays in this relationship is to prompt helping behavior. This is because an emotionally intelligent person is able to comprehend and react better to the plea of workers and spark-up positive interactions as compared to the less emotionally intelligent [11, 50]. The emotionally intelligent person is also able to capitalize and fully use changing moods of themselves and others to produce the best on a task [11]. The study by Tram and O'Hara [12] revealed that employees' emotional intelligence was strongly positively related with job satisfaction and work performance. Again, it was discovered that the emotional intelligence of managers had more positive relationship with the job satisfaction for employees who were low on emotional intelligence than for high emotionally intelligent employees. Their findings remained significant after controlling for the big five personality factors but were not significant for work performance.

Carmeli [5] studied EI, work attitudes and behavior outcomes of senior managers in the public sector. The study was to examine EI and some behavioral outcomes. The summary of the results showed that EI augments positive work attitudes, altruistic behaviors and work outcomes. It was also found that EI moderated the relationship between work family conflict and career commitment but not with job satisfaction. The details of the results obtained are as follows: EI was positively related to job satisfaction. Managers with high EI had high affective commitment towards their organization. Emotionally intelligent managers had high commitment towards their careers and were well able to manage their family work conflicts. Again highly intelligent managers had strong altruistic behavior and had less withdrawal behaviors and turnover intentions. They also engaged in more contextual and task performance activities.

Jordan and Troth [51] conducted longitudinal studies on the mediating role of Leader member exchange among emotional intelligence and work outcomes like job satisfaction and turnover intentions among 579 employees belonging to a private pathology company. In the study, employees' EI and Leader member exchange (their desires for quality relationships at the workplace with their leaders) were measured at Time 1 and then at Time 2, the job satisfaction and turnover intentions of workers were measured. Bass [31] opined that leader member exchanges are emotional interchanges that occur as followers interact with their leaders. The capacity of a manager to manage emotions at the workplace is essential for work effectiveness and performance. The study results showed a significant and positive correlation between followers' EI and job satisfaction but were negatively correlated with employees' turnover intentions. Clearly, there seems to be a strong link between EI and Leadership as well as job satisfaction.

2.5 Demographics Links with Leadership Styles, Emotional Intelligence and Job Satisfaction

Mandell and Pherwani [9] whose study showed that managers' transformational leadership styles could predict their emotional intelligence scores found age was not significant in the relationship. Meanwhile, studies have shown age to be positively related to one's emotional intelligence, length of service and leadership practices [4, 52]. In the study of Anand [4] for instance, 256 executives in South India were studied to assess their EI and possible leadership practices. The results showed that managers aged 45 years and above were more emotionally intelligent, had better interpersonal skills, problem solving skills and were more assertive than younger executives. Also those who had higher educational qualifications and served eleven to twenty years and more were more emotionally intelligent in terms of managing their stress levels and that of others and having empathy than their counterparts. In same study the difference observe for gender was not significant but women were observed to be more emotionally intelligent than men. Comparing gender in relation to transformational leadership styles was also not significant [9]. Additionally, Alston and Dastoor [14] examined 147 managers to explore whether there was a positive relationship between EI and performance. They tested the effect of demographic variables such as age, gender, education, years of

leadership experience on the relationship to examine its effect on performance. The results showed that the years of leadership experience was related to transformational leadership in that, greater years of supervisory experience was associated with how high the supervisor is rated on leadership performance.

2.6 Hypotheses

Hypotheses 1: *There will be a significant and positive relationship between emotional intelligence (EI) and job satisfaction (JS) of bank workers*

Hypotheses 2: *Transactional and transformational leadership will be positively related with workers' emotional intelligence.*

Hypotheses 3: *Transactional and transformational leadership will significantly moderate the relationship between emotional intelligence (EI) and job satisfaction (JS)*

Hypotheses 4: *Age and educational levels will be negatively related to workers emotional intelligence.*

3 Methodology

3.1 Sampling and Procedure

Purposive and simple random sampling techniques were used in selection of respondents. The purposive sampling technique was adopted because only the banks that were represented on the Ghana Club 100 ranking were considered. Thereafter, three (3) branches each were randomly selected for the study. In selecting the banks, employees of 10 commercial banks that were consistently listed on the Ghana Club 100 rankings from year 2010 to 2012 were considered. The underlying reason for selecting these companies over the three-year period is to assess the consistency of a bank in terms of their performance as measured by the Ghana Club 100. The Ghana Club 100 (GC 100), launched by the Ghana Investment Promotion Council (GIPC) is an annual compilation of the top 100 companies in the country who have exhibited corporate excellence in their business. Out of the accessible population of about 1000 employees, a sample size of 208 was estimated as appropriate using the mathematical equation developed by Krejcie and Morgan [53] for sample size determination. However, a total number of 237 questionnaires were administered to respondents out of which 208 were successfully retrieved. Strict ethical considerations like privacy, confidentiality, informed consent and voluntary participation were adhered to.

3.2 Measures

Bass and Avolio [35] Multifactor Leadership Questionnaire (MLQ) was used to assess transactional and transformational leadership style ($\alpha = .89$). MLQ is a 5 point likert scale that ranges from 1 (not at all) to 5 (frequently if not always). An example is 'my

manager provides me with assistance in exchange for my efforts’, ‘my manager instills pride in me for being associated with him/her’ ($\alpha = .89$). A six item job satisfaction scale by Brayfield and Rothe [54] was used to assess the job satisfaction of respondents ($\alpha = .82$). It was also a 5 point likert scale that ranged from ‘1’ (completely satisfied) to ‘5’ (completely unsatisfied). Higher scores reflected less satisfaction levels. An example of item on such scale is ‘I feel fairly well satisfied with my present job.’ The emotional intelligence was also assessed using the Schutte self-report emotional intelligence test ($\alpha = .85$) with higher scores indicating high emotional intelligence. Examples of items in the scale are ‘I am aware of my emotions when I experience them’; ‘I share my emotions with others’.

3.3 Analysis

The hypotheses were tested using simple linear regression, hierarchical multiple regression and partial correlation. The former was used to establish relationship between the predictor and criterion variable (i.e. EI and job satisfaction) Partial correlation was also used in order to control for the influence of other variables that are not of interest in the study. Hierarchical multiple regression was used to analyze the moderation hypothesis. Preliminary tests for normality were conducted to be sure the data was evenly distributed and normal. The skewness and kurtosis values were within -1 and +1 indicating a normal distribution of scores.

3.4 Results

Hypothesis 1: ‘there will be a positive significant relationship between employees’ emotional intelligence and job satisfaction’. The result showed a positive association between Emotional intelligence and job satisfaction but was not statistically significant ($\beta = .02, p > .05$). This however gives a basis for a moderation analysis to examine how the relationship between the said variables could be strengthened or weakened. Table 1 shows the correlation matrix of the two variables. This therefore gives a partial support for the hypothesis.

Table 1. Correlation matrix between the variables of study

Variables	Mean	SD	1	2	3	4	5	6	7
<i>Control variables</i>									
1. Age	2.75	.82	–						
2. Gender	1.48	.05	-1.5**	–					
3. Level of education	2.72	1.22	.13*	-.07	–				
<i>Study variables</i>									
4. Emotional intelligence	121.36	13.96	-.07	.03	-.17**	–			
5. Job satisfaction	16.12	5.06	-.00	-.01	-.01	-.02	–		
6. Transformational leadership	65.44	12.49	.12	-.02	.09	.12	.17**	–	
7. Transactional leadership	35.94	8.17	-.01	-.05	.03	.21**	.22**	.61***	–

Note * $p < .05$, ** $p < .001$, *** $p < .0001$

Hypothesis 2: *Transactional and transformational leadership will be positively related with employees’ emotional intelligence.* The results in Table 1 shows support for the hypothesis as transformational ($r = .12, p < .05$) and transactional leadership ($r = .21, p < .001$) had significant relationship with emotional intelligence.

Hypothesis 3: *Transactional and transformational leadership will significantly moderate the relationship between emotional intelligence (EI) and job satisfaction (JS).*

To test for the moderation effect of leadership styles (i.e. transformational and transactional), the hierarchical multiple regression was used by entering the variables in four steps. As proposed by Cohen, Cohen, Aiken, and West [52] the primary condition for testing for moderation effect is that the predictor variable(s) and the criterion variables should be related. This was realised as illustrated in the inter-correlation matrix presented in Table 1. Again, the predictor (emotional intelligence) and the moderator variables (transformational and transactional leadership styles) means were centred [53]. In addition a cross-product was formed using the centred means of predictor and moderator variables. The control variables were entered in the first block after which the main predictor and criterion variables (emotional intelligence and job satisfaction) were entered in the second step. The third step involved the first interaction term using the centred values (centred emotional intelligence * transformational leadership). The fourth step was involved the second interaction term (centred emotional intelligence * transactional leadership). The results are as follows in Table 2.

Table 2. Hierarchical regression analysis for the moderation effect of transformational and transactional leadership on the relationship between emotional intelligence and job satisfaction

Model	Job satisfaction		
	B	SE	β
1. Constant	16.36	1.89	–
Age	-.02	.44	-.00
Gender	-.09	.72	-.01
Level of education	-.02	.29	-.01
2. EI	.01	.03	.02
3. EI	-.00	.03	-.00*
Centered (EI*Transf.)	.01	.00	.17
4. EI	-.01	.03	-.03
Centered (EI* Transf)	.00	.00	.06
Centered (EI* Trans)	.01	.00	.18*

Note: * $p < .05$, EI = Emotional intelligence, Transf = Transformational leadership
 Trans = Transactional leadership

Step 1–4: $R^2 = .00; .00; .03; .05$ respectively

Step 1–4: $\Delta R^2 = .00; .00; .03; .02$ respectively

Step 1–4: $\Delta F = .01; .10; 5.95; 4.3$ respectively

The results in Table 2 supports the hypothesis in that, the model containing the interaction term at the third and fourth step was significant [$\Delta F_{(1,202)} = 5.59, p = .02$]. Transformational leadership explained 2.9% ($R^2 = .029, p < .01$) of the variance in job satisfaction as indicated in Table 2. At the fourth step the model was significant as well [$\Delta F_{(1,201)} = 4.3, p = .04$] as, transactional leadership explained 2% variance in job satisfaction ($R^2 = .02, p < .05$). This implies that though there was not a significant positive relationship between emotional intelligence and job satisfaction, the two leadership styles seem to bridge the relationship giving an indication that emotional intelligent workers were not satisfied workers until the kind of leadership styles come to play.

Hypothesis 4: *Age and educational levels will be negatively related to workers emotional intelligence.*

The results in Table 1 supports the hypothesis as age was found to be negatively related to emotional intelligence ($r = -.07, p > .01$) given the indication that emotional intelligence does not increase with one's age. Though the relationship was not statistically significant, results for educational level was ($r = -.17, p < 0.001$). This implies that emotional intelligence does not increase with high educational qualifications.

4 Discussion

The findings of the study showed positive relationship between emotional intelligence and job satisfaction and this is in congruence with the studies of Carmeli [5] who found that the emotional intelligence and job satisfaction of managers were positively related in that such managers had high affective commitment and less withdrawal behaviors to their organization. It is said that emotionally intelligent individuals are able to regulate activities in the organization in order to effectively attain organizational objectives [11, 41]. They are also able to appraise situations better hence can make better meaning of their working conditions even if it appears unfavorable. This in a way gives reasons for the positive relationship observed but not significant which implies that other factors come into play for that relationship to be significant. In addition to this, it was found that transformational and transactional leadership significantly moderated the relationship between emotional intelligence and job satisfaction. Before this, the study results showed a positive relationship between emotional intelligence and the two leadership styles which agree with some empirical studies [5, 9, 10, 14–17]. Job satisfaction has also been shown to have positive relationship with transformational and transactional leadership [6, 12, 40, 51] Given these findings from data and literature, the two leadership styles served as good moderators for the relationship which was supported by the findings of the study. This implies that emotionally intelligent workers may not necessarily be satisfied with their jobs though they are able to appropriately appraise the situation and deal with it judiciously. However, the kind of leadership style used at the workplace may facilitate job satisfaction for the emotionally intelligent. From the findings in Table 2, though both leadership styles moderated the relationship, transformational leadership rather than transactional leadership explained more variance in job satisfaction.

The results for demographic variables such as age, gender and educational level did not have significant relationships with emotional intelligence and this contradicts the study of [4]; Kaftsieos [52] but supports the study of Mandell and Pherwani [9] and Alston et al. [14] who found no significant relations among them. From the results age and educational level were negatively related with emotional intelligence implying that workers' emotional intelligence did not increase with their age or level of qualification. The difference observe for gender was also not significant but women were observed to be more emotionally intelligent than men [9].

5 Conclusion

The study results have shown the important role leadership styles play in facilitating job satisfaction among workers. It must be noted that as much as employers of organizations seek to employ emotionally intelligent individuals, they must also be mindful of the kind of leadership styles adopted if ever they desire their employees to be satisfied on the job. Though it is an important factor to have emotionally intelligent individuals on board to work, leadership styles also may affect their rate of job satisfaction. It was also noted from the study findings that emotional intelligence did not increase with age. Emotional intelligence is an aspect of social intelligence that increases with a person's conscious efforts to understand his or her emotions and that of others, interpret them correctly and use it judiciously. The myth that surrounds emotional intelligence and age is therefore cleared up in this study per the results obtained.

5.1 Implication for Practice

Emotional intelligence is a key factor known to propel success in organizations and has been related strongly to leadership styles and job satisfaction in the literature. For success in any organizations, emotionally intelligent individuals must be selected. This notwithstanding, leadership styles must also carefully be selected to boost workers job satisfaction. Thus, leadership is an integral aspect of everyday living therefore discovering the attributes of successful leadership becomes very important. This coupled with emotional intellect can produce positive outcomes in the workplace. Furthermore, in order to ensure the wellbeing of workers and promote work effectiveness, leadership style must not be overlooked because it can affect workers' overall impression they hold of their job.

5.2 Implication for Research

The issue of culture is a pertinent one when leadership styles and emotional intelligence in organizations are being discussed. For this study, culture was not investigated in the variables. Culture with regards to leadership styles for instance can be researched to know its possible influence on emotional intelligence and job satisfaction. This would help to know the basis of the type of leadership styles that are adopted. Additionally future studies could also consider the different components of job satisfaction to know exactly what kind of satisfaction bankers have for jobs (whether extrinsic or intrinsic).

References

1. Abor, J.: Technological innovations and banking in Ghana: an evaluation of customers' perceptions. *IFE Psychol. Int. J.* **13**(1), 170–187 (2005)
2. Owusu-Frimpong, N.: Patronage behavior of Ghanaian bank customers. *Int. J. Bank Mark.* **17**(7), 335–342 (1999)
3. Biekpe, N.: The competitiveness of commercial banks in Ghana. *Afr. Dev. Rev.* **23**(1), 75–87 (2011)
4. Anand, R.: Emotional intelligence and its relationship with leadership practices. *Int. J. Bus. Manag.* **5**(2), 65–76 (2010)
5. Carmeli, A.: The relationship between emotional intelligence and work attitudes, behavior and outcomes: an examination among senior managers. *J. Manag. Psychol.* **18**(8), 788–813 (2003)
6. Wong, C., Law, K.S.: The effects of leader and follower emotional intelligence on performance and attitude: an exploratory study. *Leadersh. Q.* **13**, 243–274 (2002)
7. Locke, E.A.: What is job satisfaction? *Organ. Behav. Hum Perform.* **4**(4), 309–336 (1969)
8. Bono, J.E., Ilies, R.: Charisma, positive emotions, and mood contagion. *Leadersh. Q.* **17**, 317–334 (2006)
9. Mandell, B., Pherwani, S.: Relationship between emotional intelligence and transformational leadership style: a gender comparison. *J. Bus. Psychol.* **17**(5), 387–404 (2003)
10. Morrison, T.: Emotional intelligence, emotion and social work: context, characteristics, complications and contribution. *Br. J. Soc. Work* **37**(2), 245–263 (2007)
11. Grewal, D., Salovey, P.: Feeling smart: the science of emotional intelligence. *Am. Sci.* **93**(4), 330–340 (2005)
12. Sy, T., Tram, S., O'Hara, L.: Relation of employee and manager emotional intelligence to job satisfaction and performance. *J. Vocat. Behav.* **68**, 461–473 (2006)
13. Sadri, G.: Emotional intelligence and leadership development. *Public Pers. Manag.* **411**(3), 535–548 (2012)
14. Alston, B.A., Dastoor, B.R., Sosa Fey, J.: Emotional intelligence and leadership: a study of human resource managers. *Int. J. Bus. Public Adm.* **7**(2), 61–75 (2010)
15. Barbuto, J.E., Burbach, M.E.: The emotional intelligence of transformational leaders: a field study of elected officials. *J. Soc. Psychol.* **146**(1), 51–64 (2006)
16. Barling, J., Slater, J., Kelloway, E.K.: Transformational leadership and emotional intelligence: an exploratory study. *Leadersh. Organ. Dev. J.* **21**, 157–161 (2000)
17. Harms, P.D., Credé, M.: Emotional intelligence and transformational and transactional leadership: a 37 meta-analysis. *J. Leadersh. Organ. Stud.* **17**(1), 5–17 (2010)
18. Coetzee, C., Schaap, P.: The relationship between leadership styles and emotional intelligence. Paper presented at the 6th Annual Conference for the Society of Industrial and Organizational Psychology, Sandton, South Africa (2004)
19. Wechsler, D.: *The Measurement and Appraisal of Adult Intelligence*. Williams and Wilkins, Baltimore (1958)
20. Pope, K.S., Singer, J.L.: Imagination, cognition and personality. *J. Am. Assoc. Study Ment. Imagery* **9**(3), 183–211 (1990)
21. Gardner, H.: *Frames of Mind: The Theory of Multiple Intelligences* (10th Anniversary ed.). Basic Books, New York (1993)
22. Averill, J.R., Thomas-Knowles, C.: Emotional creativity. In: Strongman, K.T. (ed.) *International Review of Studies on Emotion*, vol. 1, pp. 269–299. Wiley, London (1991)
23. Salovey, P., Mayer, J.D.: Emotional intelligence. *Imaginat. Cogn. Pers.* **9**, 185–211 (1990)

24. Salovey, P., Mayer, J.D.: The intelligence of emotional intelligence. *Intelligence* **17**, 433–442 (1993)
25. Goleman, D.: *Emotional Intelligence*. Bantam Books, New York (1995)
26. Mayer, J.D., Salovey, P., Caruso, D.R.: Models of emotional intelligence. In: Sternberg, R. J. (ed.) *Handbook of Human Intelligence*, 2nd edn., pp. 396–420. Cambridge, New York (2000)
27. Mayer, J.D., Salovey, P., Caruso, D.R.: Emotional intelligence: theory, findings, and implications. *Psychol. Inq.* **15**(3), 197–215 (2004)
28. Goleman, D.: *Working with Emotional Intelligence*. Bantam Books, New York (1998)
29. Dartey-Baah, K., Mekpor, B.: The leaders' emotional intelligence: an antecedent of employees' voluntary workplace behavior. Evidence from the Ghanaian banking sector. *Afr. J. Econ. Manag. Stud.* **8**(3), 352–365 (2017)
30. Dartey-Baah, K.: Resilient leadership: a transformational-transactional leadership mix. *J. Glob. Responsib.* **6**(1), 99–112 (2015)
31. Bass, B.M.: *Bass & Stogdill's Handbook of Leadership: Theory, Research and Managerial Applications*. The Free Press, New York (1990)
32. Yukl, G.: An evaluation of conceptual weaknesses in transformational and charismatic leadership theories. *Leadersh. Q.* **10**(2), 285–305 (1999)
33. Humphrey, R.H.: The many faces of emotional leadership. *Leadersh. Q.* **13**, 493–504 (2002)
34. Bass, B.: Does the transactional-transformational leadership paradigm transcend organizational and national boundaries? *Am. Psychol.* **52**, 130–139 (1997)
35. Bass, B.M., Avolio, B.J.: *Multifactor Leadership Questionnaire: Manual and Sampler Set*, 3rd edn. Mind Garden Inc., Palo Alto (2004)
36. Bartolo, K., Furlonger, B.: Leadership and job satisfaction among aviation firefighters in Australia. *J. Manag. Psychol.* **15**(1), 87–93 (2000)
37. Weiss, H.M.: Deconstructing job satisfaction: separating evaluations, beliefs and affective experiences. *Hum. Resour. Manag. Rev.* **12**(2), 173–194 (2002)
38. Yarmohammadian, H.M., Rad, A.M.M.: A study of relationship between managers' leadership style and employees' job satisfaction. *Leadersh. Health Serv.* **19**, 11–28 (2006)
39. Cooper, R.K.: Applying emotional intelligence in the workplace. *Training Dev.* **51**, 31–38 (1997)
40. Shimazu, A., Shimazu, M., Odahara, T.: Job control and social support as coping resources in job satisfaction. *Psychol. Rep.* **94**(2), 449–456 (2004)
41. George, J.M.: Emotions and leadership: the role of emotional intelligence. *Hum. Relat.* **53** (8), 1027–1044 (2000)
42. Higgs, M., Aitken, P.: An exploration of the relationship between emotional intelligence and leadership potential. *J. Manag. Psychol.* **18**(8), 814–823 (2003)
43. Dartey-Baah, K., Ampofo, E.: "Carrot and stick" leadership style: can it predict employees' job satisfaction in a contemporary business organisation? *Afr. J. Econ. Manag. Stud.* **7**(3), 328–345 (2016)
44. Antonakis, J.: Why emotional intelligence does not predict leadership effectiveness: a comment on Prati, Douglas, Ferris, Ammeter and Buckley. *Int. J. Organ. Anal.* **11**(4), 355–361 (2003)
45. Ashkanasy, N.M., Dasborough, M.T.: Emotional awareness and emotional intelligence in leadership teaching. *J. Educ. Bus.* **79**(1), 18–22 (2003)
46. Landy, F.J.: Some historical and scientific issues related to research on emotional intelligence. *J. Organ. Behav.* **26**(4), 411–424 (2005)
47. Locke, E.A.: Why emotional intelligence is an invalid concept. *J. Organ. Behav.* **26**(4), 425–431 (2005)

48. Dartey-Baah, K., Mekpor, B.: Emotional intelligence: does leadership style matter? Employees perception in Ghana's banking sector. *Int. J. Bus.* **22**(1), 41–54 (2017)
49. Smith, A., Oran, D., Nea, J.P.: Organizational citizenship behavior: its nature & antecedents. *J. Appl. Psychol.* **68**(4), 653–663 (1983)
50. Abraham, R.: Emotional intelligence in organizations: a conceptualization. *Genet. Soc. Gen. Psychol. Monogr.* **125**(2), 209 (1999)
51. Jordan, P.J., Troth, A.: Emotional intelligence and leader member exchange: the relationship with employee turnover intentions and job satisfaction. *Leadersh. Organ. Dev. J.* **32**(3), 260–280 (2010)
52. Cohen, J., Cohen, P., Aiken, L.S., West, S.G.: *Applied Multiple Regression/Correlation Analysis for the Behavioral Sciences*, 3rd edn. Lawrence Erlbaum Publishers, New Jersey (2003)
53. Krejcie, R.V., Morgan, D.W.: Determining sample size for research activities. *Educ. Psychol. Measur.* (1970)
54. Brayfield, A.H., Rothe, H.F.: An index of job satisfaction. *J. Appl. Psychol.* **35**(5), 307–311 (1951)

Social and Digital Views



Understanding the Nature of Entrepreneurial Leadership in the Startups Across the Stages of the Startup Lifecycle

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Abstract. Start-ups are important part of the world economy. Despite the astonishing rate of the start-up creation, their viability and success remain to be relatively low. Reasons behind the failure are diverse and complex. The leadership has been recognized as an important factor influencing the performance of start-ups. The paper argues that entrepreneurial leadership theory can effectively capture the complex processes in start-ups. The paper explores a broader understanding of the entrepreneurial leadership by examining the context around which the entrepreneurial leadership occurs. Additionally, it includes leader and follower perspective in constructing the phenomenon. Lastly, the research reveals that it is important to view the Entrepreneurial leadership as a process developing along the stages of the start-up life cycle. The findings suggest that leadership is changing across the lifespan of the start-ups and distinct conditions and features are characteristic for the entrepreneurial leadership within each respective stage.

Keywords: Entrepreneurial leadership · Leadership · Entrepreneurship · Start-up · Start-up life-cycle

1 Introduction

Start-ups are an important part of the world economy and its growth. The significance of start-ups is obvious in the UK's economy. 2016 data shows that per 10000 populations, only in London, 112.3 start-ups have been reported [1]. Despite the astonishing rate of the start-up creation, the viability and success of start-ups remain to be relatively low [1]. Reasons behind the failure are diverse and complex. Leadership has been long recognized as one of the important factors influencing the performance of start-ups [2].

Some of the mainstream leadership theories, such as Transformational Leadership and Charismatic leadership have been found to have a positive effect on growth and development of start-ups [3].

Entrepreneurial leadership is an emerging theory in the leadership research that is considered to be a more adequate way of understanding the complex leadership processes in the new venture creation and growth. The theory has been developing at the

intersection of the leadership and entrepreneurship research and is a result of exchanges of ideas and elements between two different academic fields. Until now, entrepreneurial leadership has been examined from these two loops and maintains the scholarly interest of the scholars from both fields [3].

Despite the amount of the studies produced, there is no academic consensus on conceptualizing the entrepreneurial leadership. Additionally, no sufficient measurement tools have been developed for the entrepreneurial leadership [3].

As the phenomenon is still in its infancy, it is important to explore the perceptions and views of the people involved in the entrepreneurship venture. Analyzing the themes and ideas that participants of these processes reveal, will increase the knowledge on the entrepreneurial leadership.

The paper aims to address the research gap in the literature related to the entrepreneurial leadership. In doing so, the study is designed to qualitatively analyze the nature of the entrepreneurial leadership in the selected start-ups in order to enhance the knowledge about what elements are associated with the entrepreneurial leadership and explore the context where the phenomenon occurs.

The significance of the current research needs to be viewed in the following aspects: Firstly, the present research gives more accurate understanding of the elements of the entrepreneurial leadership and outlines the specificities of the context the leadership occurs, by demonstrating personal examples of the respondent entrepreneurs. Secondly, the study offers its examination on whether the various stages of the start-up development affect the leadership processes through analyzing similarities and differences. And finally, the present research examines the leadership processes and relationships from the perspective of the leader and follower, by including both founders and employees of the start-up in the study.

2 Literature Review

2.1 Entrepreneurial Leadership

Entrepreneurial Leadership had been discussed much earlier than the term appeared. Schumpeter was one of the pioneers to connect the entrepreneurship and leadership [4]. Following that Cunningham and Lischeron (1993) have identified a number of characteristics of the entrepreneurial leader such as setting clear goals, creating opportunities, empowering people, preserving organizational intimacy, and developing a human resource system [5].

Despite the amount of the research produced there's no definitional clarity or appropriate tools to assess the entrepreneurial leadership [3]. One of the recent definitions views the Entrepreneurial Leadership as influencing and directing the performance of group members towards the achievement of organizational goals that involve recognizing and utilizing the entrepreneurial opportunities [6]. The present research follows the definition of the Entrepreneurial Leadership by Leitch and Volery (2017) suggesting that Entrepreneurship Leadership means "leadership role performed in entrepreneurial ventures, rather than in the more general sense of an entrepreneurial style of leadership" [3].

Despite of the certain similarities that the entrepreneurial leadership bears to the mainstream leadership theories, it differs in one important aspect: entrepreneurial leadership emerges in the intersection of the leadership and entrepreneurship and has a significant impact from both research areas. Thus, the entrepreneurial leadership is not considered exclusively from the perspective of leadership, but it is an integration of the leadership as well as the entrepreneurship [3, 6, 7]. Number of scholars argue, that it's a distinct leadership style with unique characteristics that set the theory apart from other leadership theories and requires discrete analysis [3, 6, 8]. Major arguments of the scholars supporting this viewpoint include the fact that entrepreneurial leadership is a merger of Entrepreneurship and Leadership so it cannot be considered from just leadership perspective [3, 6].

Significant recent trend in the entrepreneurial leadership research is shifting from the static, descriptive analysis of the phenomenon to the more dynamic visualization of the nature of entrepreneurial leadership [3].

Entrepreneurial behaviour can be relevant to many different contexts, including large organizations, non-profit, social enterprises, etc. Some academics argue that entrepreneurial leadership is not specific to any context and can be successfully utilized at any type of organization. Yet, the entrepreneurial leadership displays the biggest impact on the new venture creation and more specifically when it is utilized in the start-ups' settings [6].

2.2 Entrepreneurial Leadership in Start-up's

A significant number of academic researches has attempted to analyze leadership in the start-ups. Nevertheless, the research has mostly been influenced by the mainstream leadership theories such a transformational leadership, charismatic leadership, etc. [9]. The limited research investigates the emerging leadership theories, like entrepreneurial leadership that could be more relevant for understanding the leadership processes in the complex settings of the new ventures [3, 6].

Literature related to the entrepreneurial leadership in the start-ups has linked the concept to the innovation behaviour, as well as innovation and creativity in general. Entrepreneurial leaders are considered to be key drivers of innovation and creativity [10]. According to the study of Huang et al., the entrepreneurial leadership has a significant influence on exploratory and exploitative innovation activities in the organization. The study also highlights the influence of the environmental factors on the innovation processes in the start-ups [11]. Cai et al. [7] discuss the impact of the entrepreneurial leadership on the creativity in the organizations. Based on the social cognitive theory, researchers analyze the effect of the entrepreneurial leadership on the individual and team creativity. Quantitative analysis of the leaders and employees of the Chinese companies give interesting data on the positive influencing factors of the entrepreneurial leadership on the efficiency of the creativity both on individual and team levels [7].

2.3 Leadership and the Start-up Life-cycle

Start-up life and classification of the stages of its development are complex and ambiguous leading to significant controversies in the literature [12–14]. Understanding the leadership processes in light of this ambiguity is even more problematical, however a number of researchers have already attempted to relate and analyze two concepts:

Swiercz and Lydon [2] investigate the impact of entrepreneurial CEO on a start-up development at the different stages of the start-up life-cycle. Researchers argue and provide relevant research findings to prove the importance of the leadership in the start-up growth and success. These authors identify two distinct sets of leadership competencies (self-competencies and functional competencies) that are essential for the founders that aspire to remain in the start-up leadership at various stages of the start-up growth. Swiercz and Lydon developed a two-phase entrepreneurial leadership model relevant to the two phases (Formative and Institutional) of the start-up growth [2].

Freeman and Siegfried [12] discuss challenges that entrepreneurial leaders face on their way from launching the start-up to achieving significant growth of the venture. The researchers conclude that three major leadership challenges linked to the start-up growth process are: developing a vision, achieving optimal persistence, and executing through chaos. Respectively, the authors suggest three important capabilities that address those challenges: strategic thinking, coaching, and self-evaluation [13].

2.4 Entrepreneurial Leadership Conceptual Framework

In case of the present paper, we avoid testing any particular theoretical framework but compile the elements of the Entrepreneurial leadership conceptualization suggested by a number of authors such as the opportunity recognition, influential abilities of the leader, etc. [8, 15].

Main theoretical basis of the present research is the construct of entrepreneurial leadership developed by Renko et al. [6] which includes 8 elements for understanding entrepreneurial leaders. These behavioural characteristics are: (1) Often comes up with radical improvement ideas for the products/services we are selling; (2) Often comes up with ideas of completely new products/services that we could sell; (3) Takes risks; (4) Has creative solutions to problems; (5) Demonstrates passion for his/her work; (6) Has a vision of the future of our business; (7) Challenges and pushes other(s) to act in a more innovative way; (8) Wants me to challenge the current ways we do business. Hence, the researchers suggest the key elements of the entrepreneurial leadership and develop respective measurement tool for testing it in various contexts. By testing the reliability and validity of a tool for the entrepreneurial leadership construct, the researchers argue that the proposed construct is a valid tool as the findings of the research demonstrate the prevalence of entrepreneurial leadership among founder-leaders over non-founder leaders [6]. The concept has been criticized [16], as it mostly shows the follower's perspective and ignores how leaders perceive their abilities. Also, the construct is considered to be following the trait perspective of the leadership and has been criticised as it fails to take into account the impact of context [16].

We address the following criticism by expending the conceptual framework in the following ways:

1. Additional elements relevant to the entrepreneurial leadership will be explored.
2. In addition to the followers' perspective, the leaders' viewpoint will be included.
3. The contextual factor where each element occurs will be explored.
4. The research also builds on the literature on organizational development and growth and more specifically adopts the model for start-up growth and development introduced by Overall and Wise [13] to understand the changes in the entrepreneurial leadership process [14].

Hence, the present paper will explore the following research questions: What is the nature of the entrepreneurial leadership in the start-ups? To what extent do the stages of the start-up life cycle affect the entrepreneurial leadership?

3 Methodology

As the literature review on the Entrepreneurial leadership demonstrated, the phenomenon is still in its infancy and strives to gain the distinct shape in the big picture of the leadership research. For that reason, qualitative research was a strategic choice. Although qualitative research involves smaller samples that might not be sufficient representation of the relevant population, it still allows getting substantial insights of the experiences and perspectives from the standpoint of the representatives of a specific population.

3.1 Research Philosophy, Method, Data Generation and Analysis

The present work follows the Interpretive paradigm as we share the idea that deep meaning of the phenomena can be captured through human thoughts, by uncovering how they are understanding their world [17]. The study explores the themes, patterns, and relationship that peoples reveal when giving the account of their world; so in that sense, using the Grounded Theory is a sufficient methodological strategy [18]. The choice of the Grounded theory can also be justified, as this methodological strategy has been widely used in the leadership research and is suggested as an adequate method for generating the theory [19]. An expected outcome of grounded theory as a methodological strategy in case of the present paper would be advancing the already existing entrepreneurial leadership theory by exploring the themes and drawing generalizable findings from specific examples using the inductive approach.

The semi-structured interviewing method has been chosen for data collection. As the aim of the research is to explore the phenomenon in the real context, semi-structured interviews give a significant amount of flexibility for extensively exploring the perceptions of the research participants around the topic of research [20].

The interview protocol comprises of 3 blocks and was based on the literature on the entrepreneurial leadership. The first part contains general introductory questions aimed at setting the scene and implied some general questions about the start-up and respondent's role in the start-up. The second part includes questions that explore the

features and elements as well as the context of the entrepreneurial leadership and the third part explores the entrepreneurial leadership across the start-up life cycle.

10 entrepreneurs were selected for the interview. To identify relevant participants the purposive sampling approach has been used that followed the following criteria and representation: gender (6 males and 4 female), role in the start-up (5 employees and 5 founders), and industry (multiple industries); The average age of the participants was 31 years. The average time of the interview was 30 min. Interviews were organized during early July and early August 2018 in Central London. To preserve the anonymity the participants were coded referenced by the respective codes. Interviews were transcribed using the software www.temi.com and have been checked for accuracy by the authors to eliminate any potential errors.

Coding of the data was performed in 2 phases: at first stage, selective coding was used to categorize the data according to the themes that derived from the existing literature. An inductive approach was adopted and open coding used to analyze emerging themes and patterns reoccurring across the interviews [21].

A number of studies have employed semi-structured interviews in the entrepreneurial leadership research [19], although most of them focus only on entrepreneur-founders and do not include the followers' voice in constructing the phenomenon, which is a significant limitation of the studies mentioned above. To overcome this weakness, the present research reported both employers and founders of the start-up companies, several of them being serial entrepreneurs, having diverse experience in various start-ups. Thus, using more than one data source within the present study to examine a phenomenon increases the validity of the findings.

4 Data Findings

Below we summarize the findings from selective coding, developed based on the literature. Following to that, the findings, that have emerged through adopting open coding, are presented.

4.1 Understanding Nature of Entrepreneurial Leadership

Introducing the term entrepreneurial leadership made it clear that none of the participants were familiar with the concept, but all of them were able to elaborate their own understanding of the entrepreneurial leadership. While doing so, the participants focused on various important aspects.

What is Entrepreneurial Leadership? All participants suggested that Entrepreneurial leadership in start-ups is different from the leadership in other settings. When discussing the differences, participants highlighted contextual factors such as uncertain environment, absence of formal structure, limited availability of resources, etc. that would require specific leadership behaviours. Additionally, the participants stressed the attributes and qualities of the founders such as risk-taking, innovative, and passionate that would define entrepreneurial leadership in start-ups.

Why is Entrepreneurial Leadership Important in the Start-up? When defining leadership in the start-ups, both founders and employees agree that leadership is an

essential element for the start-up development and growth. When sharing their views on how the leadership is enacted in the start-up both founders and employees suggested that it is essential for the leader to have the necessary knowledge of all aspects of the start-up work and having self-awareness of why he/she is starting a new venture. Interviewees also reveal the factors that lead to the successful entrepreneurial leadership, among those they stress the human resource aspect, ability to find the right people and create a sustainable team. Furthermore, participants suggest the importance of the values and ethical conduct that the leader-founder brings into the company.

4.2 Elements and Features of the Entrepreneurial Leadership

The research revealed that the major elements that interviews identify with regards to the entrepreneurial leadership are similar to the elements suggested by Renko et al. [6] and other authors referred to in the literature review section. Participants describe interesting examples related to each element and give important contextual specificities related to each element. Participants of the research suggest that “risk”, “passion”, “vision” and creativity/Innovation are major elements of the entrepreneurial leadership in start-ups and those elements can be exhibited in various ways.

Risk: Both founders and employees of the start-up believe that risk is associated with every single aspect of the start-up life. 3 out of the 5 founders have quit their job before starting their start-up, which they consider to be the major risk they have taken. Both founders and employees agree that it is important to carefully analyze and be sensible about risks in order to manage and averse those.

Vision: Vision is another essential element of the entrepreneurial leadership according to the participants of the study. They highlight the importance of having a clear vision for the future of the start-up that affects the organizational effectiveness, team spirit and confidence of the actors connected to the start-up.

Passion: Interviewees consider an essential element for the entrepreneurial leaders to have a passion that helps them empower the team, enables leaders to keep motivation during challenging times. Passionate leaders are more successful with raising funds and scaling up the process.

Innovation and creativity: Innovation and creativity have been used as the interchangeable terms and have been considered as one of the key elements of the entrepreneurial leadership. Participants believed that innovativeness has to be considered at every aspect of the start-up leadership, it should be the way the leaders think and act and enable others to perform in a more innovative way. Employees and founders’ perceptions differ on how the innovation is enacted in the start-up. Start-up leaders think that any employee, including interns, should think and act innovatively. While employee’s perspective suggests being more cautious about forcing innovation on others within the entrepreneurial teams. Employees also state that it depends on the founder’s leadership to materialize and implement innovative ideas that employees are coming up with. Innovation is considered to be the way start-ups deal with the day-to-day challenges. Specificity of the start-up context demand more innovative, fast solutions and decision-making from all actors involved in the start-up.

4.3 Entrepreneurial Leadership as a Process

Participants share the view that entrepreneurial leadership is not a fixed state; quite the reverse, they believe it is a dynamic process of change and is influenced by various factors. Questions were formulated in a way to capture the perceptions and experiences of participants view of Entrepreneurial Leadership across various stages of the start-up growth. Chart demonstrating the four stages of the start-up life cycle [14] has been displayed and participants were asked to elaborate on entrepreneurial leadership processes relevant for each stage.

Both the employees and the founders participating in the study differentiate entrepreneurial leadership at 4 exhibited stages of the start-up development and consider various aspects and factors contributing to shaping leadership at every stage of the start-up life. The related findings are summarized below:

Stage 1: Majority of the participants characterize the leadership in the initial stage of the start-up development as “passionate”, “courageous”, and “resilient”. Interviewees believe that these are the leadership traits and behaviours that are essential in order to push forward the innovative idea to transform into a start-up, as well as to cope with the volatile environment.

Stage 2: Participants link this stage with agile and open leadership.

Stage 3: Most of the interviewees share the idea that at this stage leadership focus shifts to building up the right team and sourcing the right talents, one of the interviewees naming it as a “Lean leadership”.

Stage 4: Interviewees suggest that at this stage leader should focus on assigning right roles in the team, empowering the people and sharing the leadership responsibilities.

4.4 Leadership in the Contexts of the Leader-Follower Relationship

The topic of sharing leadership responsibilities among various actors in the start-up as well as shifting leadership roles among the collaborators have emerged as a distinct theme during the interviews. Participants justify the importance of sharing leadership with the specificities of the start-up environment such as a need for a fast decision-making, small teams, the absence of the hierarchy and importance of sustaining available human resources.

Key challenges in the leader-follower interaction, that some of the interviewees suggest, is the ego of the leaders and desire to retain own power and decision-making in the company. Participants opinion differ on how receptive the start-up leaders are when followers challenge the way they do business. There was a clear discrepancy in the way employees and founders viewed and described this aspect of leadership. While founders suggest that they are open to the ideas and suggestions from all collaborators, employees disagree and give examples of the opposing trend.

4.5 Big Company and Start-up Opposition for Understanding Entrepreneurial Leadership

Another important theme, which has emerged during the analysis of the patterns and reoccurring themes in the data, is related to the size of the organization. All participants attempted to understand the entrepreneurial leadership by contrasting start-up environment with “big companies” and “large organizations”. There is a number of important differences, according to the participants that lead to distinctive leadership behaviour linked to those two environments: Secured setting as opposed to uncertainty - of the start-up environment, the absence of the structure and hierarchy and the distinct potential for developing leadership abilities. Big companies have more opportunities for developing leadership abilities as opposed to start-ups, where natural leadership potential of an individual is considered as important factor influencing the leadership in those settings.

5 Discussion and Implications

5.1 Entrepreneurial Leadership

The main objective of the present research is to understand the nature of the leadership in the start-ups. In doing so, the key elements of the entrepreneurial leadership were explored: why the entrepreneurial leadership is important and how it is utilized in the start-ups’ settings in order to answer this main research question we have outlined.

The Conceptual framework was based on the entrepreneurial leadership construct proposed by Renko et al. [6] that suggest 8 distinct elements of the entrepreneurial leadership. Interview questions were framed around those elements, additional elements referenced in the literature have been added such as opportunity recognition and utilization, influencing abilities, being a role model, etc. [6]. The format of the semi-structured interview and open-ended questions gave freedom and flexibility to the participants to define what other elements they consider relevant for the entrepreneurial leadership based on their life experiences. All that gave sufficient qualitative data that can be generalized beyond the 10 start-ups that the interviewees represent.

Overall findings of the present study demonstrate that the entrepreneurial leadership has a significant impact on start-ups. A number of distinctive features such as vision, passion, risk, innovation, and creativity have been emphasized by the small sample of the study participant entrepreneurs. Although the elements listed here have been already discussed by a number of authors [8, 15] in relations with the entrepreneurial leadership, the previous studies have mostly used the quantitative tools to study the construct that limited the understanding of how and why these elements occur in certain settings. The present study, on the other hand, gathered rich contextual data outlining details on the context and factors that surround each element, analyzing reasons for the occurrence of each element in a particular entrepreneurial setting.

5.2 Entrepreneurial Leadership Across the Start-up Life-cycle

Scholarly work of the recent years has increasingly focused on understanding the entrepreneurial leadership as a process [3]. Leitch and Volery [3] suggest that entrepreneurial leadership as a social process drawing on the human capital and social capital theory. Freeman and Siegfried [12] view entrepreneurial leadership in the context of the start-up growth outlining key challenges that entrepreneurial leaders need to overcome in the process of the start-up development and suggesting that the adequate capabilities of the leaders strategic thinking, coaching, and self-evaluation [13]. Another academic paper that pioneered linking the leadership and start-up development in the scholarly research has been produced by Swiercz and Lydon [2]. The two-phase entrepreneurial leadership model explicitly includes the leader as an essential part of the organizational transition and life cycle [3].

Building upon the scholarly work that we have outlined and considering the gap in the research that calls for a better understanding of the leadership processes in various contacts across the time present paper has adopted the four-stage S-curve model developed by Overall and Wise [13]. The proposed model gives a holistic view of the start-up-lifespan by incorporating the innovation life-cycle, customer development and funding stages of the start-ups as key element influencing each stage.

The findings suggest that the leadership is changing across the lifespan of the start-up and distinct conditions and features are characteristic for the entrepreneurial leadership within each respective stage.

5.3 Entrepreneurial Leadership as a Leader/Follower Co-creation

Recent academic efforts in the leadership research demonstrate increased scholarly interest in understanding the leadership as a co-creation of the leader and follower. The interest is shifting from the top-down understanding of the leadership to the flat leadership construct. In line with these developments the concepts of the shared [22] and distributed [23] leadership emerged, that attempt to capture the nature of leadership in contrast with the top-down leadership approach focuses more on abolishing hierarchies in leadership enactment and gives space for various actors in the organization to act as a leader in diverse conditions. Scholars have noted that the shared and distributed leadership have been theoretically conceptualized while still lack the evidence [22]. Studies that have previously analyzed the shared leadership in the new ventures suggested that shared leadership has a positive impact on the team performance in the new ventures [23].

Start-up with the flat hierarchical structure is a perfect environment where shared and distributed leadership patterns could be traced. Thus, it was not surprising that the elements and themes related to the shared/distributed leadership and leader/follower relationship dynamics have emerged from the findings presented here. Firstly, the finding demonstrates the interdependence of the actors. All actors are equally important for the success if any of those fail, start-up risk for the major failure. The finding also acknowledges the significance of the teams for the start-up work. All participants have highlighted developing the team as an essential condition for the start-up success.

Findings related to the leadership in four stages of the start-up lifecycle give additional specificities on the topic, suggesting that the development and growth of the team, sourcing the relevant people, sharing and delegating responsibilities and assigning the right roles to the team member are critical during the 3rd and 4th stages of the start-up development. In addition to this, findings suggest a more important role and contribution of followers in the leadership co-creation. While the entrepreneurial leadership theory, along with other mainstream leadership theories focuses largely on the leader and understands leadership mainly from leader's perspective, the present research has attempted to show both leader and follower perspective for understanding the entrepreneurial leadership in start-ups. The recent study targeted both the follower and leader for generating respective data and gave both accounts in the findings of the study.

5.4 Contextual Factors Defining Leadership in Start-ups

An important gap in the literature on the entrepreneurial leadership has been related to the limited understanding of the context where the entrepreneurial leadership occurs and factors that influence the phenomenon in various environments [15, 16].

Ireland et al. [14] have discussed the opposition of the big company and start-ups with regards to leadership. Researchers suggested that in large organizations entrepreneurial leadership is mostly concerned with collecting the right resources and is considered to be a foundation for the strategic decision-making. In contrast to the new ventures, entrepreneurial leadership is connected to developing innovative approaches for solving the problems of the customers [15].

The findings presented in this research reveal that the contrasting settings of the start-ups and big organizations appear to be important influencing factors for developing the entrepreneurial leadership in a particular setting. More specifically, the findings suggest the following influencing factors: secured setting as opposed to uncertainty, absence of the structure and hierarchy, and leader's development track as the key conditions shaping leadership in those environments. Relevant examples and individual experiences of the entrepreneurs participating in the research have been analyzed.

6 Conclusion

In summery we can point out that the mainstream leadership research does not allow full understanding of the leadership processes in the start-ups at different stages of its development. We suggest that the entrepreneurial leadership theory is a more relevant construct for understanding and capturing the complex processes in a highly volatile environment. We believe that the present paper deepens the scholarly knowledge on the nature of the entrepreneurial leadership by investigating entrepreneurial leadership in the start-ups setting, including through the perspectives of the leader and follower in constructing the concept and capturing the entrepreneurial leadership process across the lifecycle of the start-ups.

References

1. Statista—The Statistics Portal for Market Data, Market Research and Market Studies. <https://www.statista.com/>
2. Swiercz, P., Lydon, S.: Entrepreneurial leadership in high-tech firms: a field study. *Leadersh. Organ. Dev. J.* **23**, 380–389 (2002)
3. Leitch, C., Volery, T.: Entrepreneurial leadership: insights and directions. *Int. Small Bus. J.* **35**, 147–156 (2017)
4. Schumpeter, J., Schumpeter, E.: *History of Economic Analysis*. Routledge, London (1997)
5. Cunningham, J., Lischeron, J.: Entrepreneurship: some popular impressions and new information. *J. Small Bus. Manage.* **10**, 46–50 (1993)
6. Renko, M., El Tarabishy, A., Carsrud, A., Brännback, M.: Understanding and measuring entrepreneurial leadership style. *J. Small Bus. Manage.* **53**, 54–74 (2013)
7. Cai, W., Lysova, E., Khapova, S., Bossink, B.: Does entrepreneurial leadership foster creativity among employees and teams? The mediating role of creative efficacy beliefs. *J. Bus. Psychol.* (2018)
8. Gupta, V., MacMillan, I., Surie, G.: Entrepreneurial leadership: developing and measuring a cross-cultural construct. *J. Bus. Ventur.* **19**, 241–260 (2004)
9. Zaech, S., Baldeger, U.: Leadership in start-ups. *Int. Small Bus. J.* **35**, 157–177 (2017)
10. Denti, L., Hemlin, S.: Leadership and innovation in organisations: a systematic review of factors that mediate or moderate the relationship. *Int. J. Innov. Manag.* **16**, 1240007 (2012)
11. Huang, S., Ding, D., Chen, Z.: Entrepreneurial leadership and performance in Chinese new ventures: a moderated mediation model of exploratory innovation, exploitative innovation and environmental dynamism. *Creat. Innov. Manag.* **23**, 453–471 (2014)
12. Freeman, D., Siegfried, R.: Entrepreneurial leadership in the context of company start-up and growth. *J. Leadersh. Stud.* **8**, 35–39 (2015)
13. Overall, J., Wise, S.: An S-curve model of the start-up life cycle through the lens of customer development. *J. Priv. Eq.* 150213200538007 (2015)
14. Ireland, R., Hitt, M., Sirmon, D.: A model of strategic entrepreneurship: the construct and its dimensions. *J. Manag.* **29**, 963–989 (2003)
15. Harrison, C., Paul, S., Burnard, K.: Entrepreneurial leadership in retail pharmacy: developing economy perspective. *J. Work. Learn.* **28**, 150–167 (2016)
16. Bryman, A., Bell, E.: *Business Research Methods*. Oxford University Press, Oxford (2015)
17. Corbin, J., Strauss, A.: Grounded theory research: procedures, canons and evaluative criteria. *Z. Für Soziol.* **19** (1990)
18. Kempster, S., Parry, K.: Grounded theory and leadership research: a critical realist perspective. *Leadersh. Quart.* **22**, 106–120 (2011)
19. Punch, K.: *Introduction to Social Research*. Sage, Los Angeles (2014)
20. Saldaña, J.: *The Coding Manual for Qualitative Researchers*. Sage, Thousand Oaks (2009)
21. Ensley, M., Hmieleski, K., Pearce, C.: The importance of vertical and shared leadership within new venture top management teams: implications for the performance of startups. *Leadersh. Quart.* **17**, 217–231 (2006)
22. Gronn, P.: Distributed leadership as a unit of analysis. *Leadersh. Quart.* **13**, 423–451 (2002)
23. Shamir, B., Lapidot, Y.: Trust in organizational superiors: systemic and collective considerations. *Organ. Stud.* **24**, 463–491 (2003)



Social and Economic Principles of Single Mothers' Support in Ukraine

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Abstract. The article clarifies single mothers' social needs and interests. Suggestions for improving the sphere of social services provision and new forms of social support for this category of citizens have been made on this basis. It has been determined that organizational content and socio-economic aspects of social services have to be developed and improved. The article defines that it is urgent to create conditions for the inclusion of the non-governmental sector in the provision of social services to single mothers, expand the range of services oriented towards the prevention of social orphanhood and form conscious paternity and social rehabilitation. The results of the study showed that it is expedient to initiate new forms of social support at the community level, including special education courses and single mothers' training, social rental service, social specialized baby shops, helplines, hot lines, children's rooms and baby rooms, courses for future mothers and young mothers, self-care groups, leisure centers at the place of residence, etc.

Keywords: Single mothers · Social work · Social services · Social security · Socio-economic measures

1 Introduction

The socio-economic crisis, the ongoing military conflict in the Eastern Ukraine, the tight austerity measures taken by the Government reinforce the gender imbalance in society, leading to some consequences, such as: feminization of poverty; loss of work by women; difficulties to access medical, educational and social services; increase of cases of domestic and sexual violence, including those related to the military conflict; strengthening of patriarchal gender stereotypes and the traditional division of social roles.

On October 10, 2018, parliamentary hearings on the topic "Preventing and resilience of discrimination of women from vulnerable social groups" took place due to the need for effective parliamentary supervision and identification of problematic aspects in the field of public relations in preventing and resilience of discrimination of women from vulnerable social groups; the development of effective mechanisms to protect the rights of women from vulnerable groups based on the principle of equal rights of women and men and non-discrimination.

Economic, social and cultural rights are of particular importance for women from vulnerable social groups as they suffer disproportionately from poverty, social and cultural marginalization. It enhances their subordination and limits their exercise of any other right. As a result, women from vulnerable groups have unequal access to resources and services, and less power in the political, economic and social spheres.

Single women with children are among the most vulnerable population stratum. Due to the social cataclysms and economic crises, the demand for social services for this category of citizens is increasing, which requires a detailed study and development of organizational, content and economic principles of social service provision.

Thus, over the past 15 years the number of single mothers in Ukraine has increased 22 times. As of 2018, in 20% of families children are raised by single mother and they are mostly needy families. According to statistics, every fifth child today has no official father.

Among the prerequisites for the emergence of such a vulnerable category as single women with children there are the following: divorce (today there is a crisis of the Ukrainian family – 61% of married couples get divorced), extra-marriageable birth (an increase in the number of civil marriages is accompanied by an increase in the number of illegitimate children), widowhood (military conflict in the East causes an increase in the number of this category), adoption (increasing tendency for adoption by single woman or man), etc. In this context, social work should be focused not only on improving social services provision in the form of social security and social services, but also on developing a strategy for overcoming early pregnancy, improving the status of women in the labor market and in business, expanding access to educational and medical services, detection and implementation of socio-psychological support at early stages in the process of divorce.

2 Literature Review

The issues of the theory and practice of social services for vulnerable groups of the population have been studied by such scientists as A.I. Ivanova, Mikhnenko, I. Mygovych, P. Nadolishny, T. Semygina, L. Skoropada, L. Tyuptya, V. Zagorsky, I. Zviereva, and others.

Various aspects of the problem of population social protection are covered in the scientific works by S. Bandur, K. Batygina, N. Bolotina, N. Boretska, M. Kravchenko, M. Moklyak, O. Novikova, O. Paliy, O. Petroye, O. Pishchulina, O. Savchenko, Yu. Sayenko, T. Semygina, B. Stashkiv, V. Skurativsky, P. Sytnik, V. Troshchynsky, K. Vashchenko, N. Yarosh and others.

The research of I. Chekhovska has made an analysis of Ukrainian legislation regarding the provision of state social benefits and other guarantees for single mothers, has identified the shortcomings of its legal foundation, has identified areas of improvement, taking into account the positive foreign experience (Chekhovskaya 2017).

UK experience on single mothers' socio-economic support in the development and adoption of equal opportunities legislation is presented in Wendy Sigle's work

“England and Wales: Stable fertility and pronounced social status differences” (2008) (Sigle-Rushton 2008).

The gender component of social work is highlighted in Stephen Hicks's work “Social work and gender: an argument for practical accounts” (Hicks 2015), which involves relations between professionals and clients, as well as between the client and the state. Therefore, a wide range of social work clients, establishments and institutions that provide social services require different treatment for men and women, including single mothers.

The Oxford edition “Encyclopedia of Social Work” (Encyclopedia of Social Work) states that the essence of social work with single mothers is to increase family allowances and child support, as well as to develop measures to prevent teenage pregnancies, expand access to education and employment, identify low-income mothers.

The article by C. Anne Broussard, Alfred L. Joseph and Marco Thompson “Stressors and Coping Strategies Used by Single Mothers Living in Poverty” is especially noteworthy (Broussard et al. 2012).

This work highlights the consequences of the difficulties that are experienced by single mothers, namely stress and poverty. The findings are based on a survey of single mothers, which allowed to highlight important social values associated with social justice, dignity and competence. Authors offer social services that help to improve the conditions for people living on the poverty line, as well as measures that minimize the consequences of stress.

3 Methodological Approach

The purpose of the article is to analyze legal and regulatory framework for the social protection of single women with children, in particular the provision of their rights to receive social services, to find out the mechanism of providing social services to women in the conditions of a territorial community, to suggest measures and proposals on social practice of this category of citizens.

The methods of research are: analysis of Ukrainian legislation on granting state social benefits, privileges and other guarantees to single mothers; a survey based on a targeted sample of 15 women aged 18 and over from rural and urban areas in order to find out their social needs and interests; questionnaire survey on single mothers' financial living conditions and professional employment (40 single mothers participated in the questionnaires).

The participants of the study were selected with the help of students - future social workers within the framework of passing practice on the basis of social institutions, as well as specialists of the centers of social services for children, families and youth of the region; studying and analyzing the reports of the Centers for Social Services for Children, Families and Youth, which are available on the Internet. In order to find out the range of social services for single mothers, an analysis of the sites of the Regional Centers for Social Services for Children, Family and Youth was conducted.

4 Conducting Research and Results

In general, social services provision is provided by law if a person or a particular social group is in difficult circumstances and can not independently overcome them. Therefore, difficult circumstances are defined as circumstances caused by disability, age, state of health, social status, life habits and way of life, as a result of which the person has, partially or completely, no ability or opportunity to take care of his or his family's life and participate in public life (Law of Ukraine "On Social Services").

At the same time, the abovementioned people fall into the category of "vulnerable groups" as potential recipients of social services that have the risk of falling into difficult living conditions due to the influence of external factors (social, economic, natural, political, environmental, etc.) and internal factors (material, physical and mental developmental defects, age, lifestyle, etc.) (Kiyannitsa and Petrochko 2017).

This category includes single women with children. The legal definition of a term "single mother" is given in part 13, article 10 of the Law of Ukraine "On Vacations". So, single woman is a mother who takes care of a child without a father. According to article 18-1 of the Law of Ukraine "On the State Assistance to Families with Children" several categories of people have the right for respite services. They are unmarried single mothers, single adopters, if the birth certificate (or the decision on the adoption of a child) does not include a record of the father (or mother) or a record of the father (mother) was conducted in accordance with the established procedure by the state body for registration of acts of civil status on the instructions of the mother (father, adopter) of the child. Single mothers also include widows, women who bring up a child without a father. The latter include divorced women who raise their own children, even if they receive alimony. A woman who is married, but her husband has not adopted her baby, is also considered to be single (Chekhovskaya 2017). The article will be focused on unmarried single women and bring up their children by themselves.

According to the Law of Ukraine "On Social Services", social security is the main form of social services. It is important to review the forms of social security for this category of citizens in accordance with the current legislation. According to article 5 of the Law of Ukraine "On Social Services", social security is a financial assistance provided to people in difficult living conditions in the form of cash or natural aid (food, sanitary and personal care products, childcare facilities, clothing, footwear and other essentials, fuel, as well as technical and auxiliary means of rehabilitation) (Law of Ukraine "On Social Services").

So, we understand the term "social security" as the form of provision of social services aimed at the financial assurance of single women with children at the expense of the state budget and special extrabudgetary state funds, in case of loss of source of subsistence, appearance of additional expenses or lack of necessary poverty level according to objective, socially significant, determined by law, reasons for equalizing the social status of these citizens compared to other members of society.

According to existing laws, the main criteria for receiving social assistance for children by single mothers are: family structure, income level (insufficient standard of living conditions), age of children. It is obvious that it is difficult for a single woman to provide proper financial situation of the family independently and fulfill the functions

of mother (care of the child, cooking, maintenance of sanitary conditions) and father (financial provision of the family with stable earnings, housing, etc.) at the same time. Even receiving the state social assistance or alimony does not significantly improve the situation of an incomplete family. In addition, single mothers who do not work, mothers with several children who work, but do not have housing are in a very difficult financial situation (Chubuk 2017).

The legal basis for the social protection of single women with children is the "Family Code of Ukraine", the Laws of Ukraine "On the Protection of Childhood", "On State Social Standards and State Social Guarantees", "On State Assistance to Families with Children", "On State Social Assistance to Low-Income Families, Decree of the President of Ukraine "On Additional Measures to Strengthen Social Protection of Large Families and Single-Parent Families", etc.

However, it should be noted that there is no specific legal act that would define social rights, social benefits and services that are provided to single-parent families. That is a negative factor, as the uncertainty of statutory regulation of social protection of single-parent families leads to violation of their fundamental rights.

In the context of social protection of this category of citizens, the content of the social worker's professional activity is as follows: the initiative to identify single mothers who need help; help in processing documents for receiving social assistance; providing advice for the development of the ability to find the optimal solution in a difficult situation and enhance the internal resources of the individual; appeal to appropriate charitable foundations that could provide financial assistance both for the mother and the children. It is extremely important at the same time to identify and assess the financial needs of such families formally or informally; find the opportunity for financial assurance of the family needs; provide financial assistance in a proper way, without humiliating mother's dignity and children's psychological well-being (Chubuk 2017).

Single women with children need other types of social services alongside with social assistance. They are social-psychological, social-legal, employment services, etc., which are forms of social services. According to the current legislation, social services are aimed at providing various services to citizens by special bodies of the state free of charge or on a partial payment basis in order to prevent the occurrence or reduction of the negative consequences of the social risks that have appeared, in order to strengthen their social protection.

Employment is one of the services in demand. It allows not only earning income to meet the basic needs of the woman and children, but also improves mental health. It is the stress of unemployment that is most probable for single women, and full employment and permanent income have a beneficial effect on the psychological state (Broussard et al. 2012). However, today realities show that a significant percentage of single mothers have low income, a lot of women have no opportunity to work, as employers do not agree on part-time work, there is no flexibility in working hours. Taking into account the current economic crisis, it is likely that some single mothers have to work more while others have lost their job at all.

In this regard, the experience of Great Britain seems to be interesting, as this country has the highest birth rate among Western European countries. Legislation on equal opportunities is strong, but among the priorities is the support of single mothers'

employment in the form of regulation or childcare services provision. Therefore, women have the opportunity to receive childcare services with simultaneous employment during the working day, thus providing an appropriate level of income support (Sigle-Rushton 2008).

Along with the employment single women need *psychological help*. After all, worries about work, housing, food, insecurity, discrimination, violence, etc. contribute to the emergence of stress. At the same time, the poor amounts of financial assistance, the lack of support from relatives and close friends, the loss of a sense of security, all this makes them vulnerable as compared to married women. Thus single women are more inclined to mental and physical health disorders, in contrast to their “colleagues”. Their psychological state tends to be difficult given that they may have experienced unemployment, low level of social support, family violence, divorce, etc. According to foreign scientists, the more economic difficulties there are among poor mothers with children, the greater is the possibility of mental health deterioration. Studies have shown that single women with children are twice as likely to suffer from clinical depression, compared to women from complete families (Broussard et al. 2012).

Another problem of single mothers with children is, above all, the problem of loneliness, which is associated with depression. There are also women who, after giving birth to children and staying alone, are desperate, and begin to abuse alcohol, therefore forget about children. A lot of single mothers with children may possess low self-esteem, negative self-esteem, and uncertainty in their professional competence, which can have real grounds and act as a result of mother’s high self-criticism. A similar tendency can negatively affect single mother’s private life and life style, cause constant anxiety, inability to cope with the difficulties that arise, create an obstacle in the child’s upbringing.

It is absolutely obvious that single mothers face many psychological problems. They need skilled help in solving these problems in order to form a stable model of mother’s positive behavior, to relieve emotional stress and increase her personal growth.

At the same time, taking over the role of the father and associated with it mothers’ emotional and physical pressure increases nervous tension to some extent, intensifies conflicts with the child, thereby accelerating the process of his neuroticism. However, upbringing in single-parent families is a prerequisite for the child to be at risk of not receiving the social experience in the sensitive periods of his development, which in the future may serve as the basis for the formation of an intellectual, emotionally mature, and morally stable personality. In addition, the lack of male influence can negatively affect the child’s mental and personal development, the process of his socialization and gender-role identification. Therefore, *the qualified social and pedagogical assistance to mothers and their children* seems to be reasonable and motivated.

At the same time, scholars state that a single mother, as a rule, has a sufficient reserve of positive resources to overcome difficulties. But, in order to cope with them, a single mother needs professional social and psychological assistance and competent support to develop an exit strategy. Professional assistance is a leading component of her psychological well-being, which enables her to realize her potential, overcome stress, bring up children, effectively carry out professional activity and be useful to society.

At the same time, in addition to employment, in order to provide basic income to meet the needs of an incomplete family, without relatives' support, single mothers in most cases do not have the opportunity to obtain *education and self-education*. Since getting a profession reduces the possibility of poverty it is a prerequisite for economic self-sufficiency. According to the current legislation, women have the right to an individual educational plan at higher education institutions to take care of the child until the age of three years. However, this standard is prescribed for women in general. There are no benefits for single mothers, and this, in our opinion, discriminates their access rights and equal conditions for obtaining education.

This issue is especially acute due to the disappointing dynamics of a new type of an incomplete family that *is a minor mother with a child or children*. Often children of such mothers, who are socially and morally not ready for the upbringing of children, replenish a group of social orphans. It is a threatening challenge for social services, which requires not only the development of innovative approaches to accompany such families in order to ensure optimal conditions for the upbringing of children, but also the working out of organizational and substantive principles of social and educational formation of the a young mother's personality.

In general, it is necessary for single women with children to have the possibility of obtaining *social services in legal education* that would enable women to gain basic knowledge of their rights and responsibilities, to study the legislation on equal rights of women and men, on discrimination resistance, to find out the conditions and mechanism for financial assistance obtainment, etc.

At the same time, single mothers earn their living independently, which reduces the time for raising children - this can provoke the problem of the asocial behavior of the younger generation. In addition, the system of leisure activities in the community under the conditions of reduction of out-of-school institutions is also a problem. Therefore, leisure activities for single mothers are often limited, especially in rural areas. As a consequence, there is a danger that children and adolescents may be exposed to the influence of street during the out-of-school time. Thus this situation can lead to manifestations of various forms of deviations in the behavior of minors. The above-mentioned facts require focusing the efforts of the authorities and the non-governmental sector at the community level towards expanding the range of *social services in the field of leisure, recreation and rehabilitation of school-age children*.

Among the issues that are hardly covered and not practiced regarding the social protection of single mothers there are health care measures. After all, women in this category often ignore their health in favor of obtaining medical care by children because of various reasons: lack of time, workload, financial situation, lack of knowledge on the formation of a healthy lifestyle, etc. Therefore, medical and social services, which provide advice on preventing the occurrence and development of possible personal organic disorders, preservation, support and protection of health, the implementation of preventive, health related measures, etc. are of vital importance nowadays.

Particularly acute is *the issue of raising children with disabilities by single women*. There were more than 160 thousand of such families in Ukraine in 2017. If a child with disabilities needs constant care and is brought up in a single mother's family, then such

mother has no opportunity to improve the financial well-being of the family, and they have to live on a child's disability pension and child financial assistance.

5 Results

In order to study the situation of single women with children, we have conducted a research, the results of which help to analyze the existing state of social work with this category of citizens, as well as suggest ways of its improvement.

In particular, a questionnaire survey on the peculiarities of the lifestyle of single mothers with children made it possible to find out the socio-economic conditions of single mothers' life. 40 single mothers took part in the survey. The conducted research revealed the following indicators: According to the family status: 70% are divorced; 17% are single; 13% are widows. According to the quantity of children: 1 child have 67.5%; 2 children have 25%; 3 and more children have 7.5%. Housing conditions: 80% have their own housing or rent an apartment; 20% live with parents. Education: 45% have secondary vocational education; 25% have incomplete higher education; 30% have a complete higher education. According to the main occupation: 37.5% work on a regular basis; 10% are engaged in private entrepreneurship; 52.5% are housewives or do not work temporarily. There was a question "What is the family for?": 75% answered that it is happiness and propagation; 25% answered that it is a habit. There were such answers to the question "Have your expectations for family life been met?": 87.5% answered that it is very unlikely; 32.5% believe that financial well-being and everyday comfort brought them real pleasure in their family life; 22.5% suppose that happiness in their children have brought and brings them real pleasure in family life; 5% believe that routine and quarrels have destroyed their family life. According to giving birth and divorce: 37.5% of single mothers agree that you need to stimulate the increase in fertility; 25% are sure that now it is not the time to give birth; 12.5% believe that you need to make sure that the divorce procedure is easier. Such number of people like the family form most of all: - 25% like it in the form of free relationships; - 75% like it in the form of a marriage contract. There were some negative phenomena that single mothers had to face with: - 80% - constant critical remarks, pressure and imposing of unwanted acts, inattention and indifference; - 20% - violence and aggressive behavior, restriction of personal freedom, rude attitude and insult. Attitude towards parents' way of life: - 37.5% are not fond of their parents' way of life; - 62.5% suppose that it deserves to be respected; - 75% would like their family life to resemble their parents' life; - 25% would not like their family life to resemble their parents' life; 37.5% receive financial assistance from their parents, but would be able to live without it; 42.5% cannot live without parents' financial assistance; 20% do not need financial assistance from their parents; The financial position of 30% of respondents became worse, comparing with 2017 and 70% showed the same result. The basic income of an incomplete family consists of: - 52.5% mother's salary; - 25% the state financial assistance; - 22.5% alimony. Expressions that are most relevant to the economic situation of the single mothers' family: - 75% have to work hard to earn a living somehow; - 12.5% make ends meet; - 12.5% find it difficult to answer. Single mothers pay a lot of attention to such things: - 67.5% want to feed their children, get them

clothing, give a good education; bring up a cultural, moral personality; raise hard working nature; - 32.5% try to make their children earn money by themselves as quick as possible; pay great attention to physical education; raise religiosity; - 100% of single mothers spend more than an hour a day on their child's education.

Single mothers are a heterogeneous group of population. They all differ in their marital status, household structure, and the number of children, education and parents' employment status, type of residence and a whole range of other indicators.

In this regard, a comparative analysis of the situation of single mothers in rural and urban areas has been carried out. In terms of employment, this indicator is higher in the city, it is 67%, while in the countryside it comprises 40%. In urban areas, respondents have more access to leisure and recreation services for children - 60%, and in the countryside this figure is only 25%. There were also the following answers: 'it is also leisure time when the kids feed the cows', 'there is time for leisure, but no time for recreation', 'there is no time for rest', etc.).

The results converge in spite of the place of residence according to the following indicators: 68% indicated that the most difficult period in children upbringing was up to 3 years old, 20% - up to 5 years, 28% indicated that the whole period was difficult. 60% of women receive help for children upbringing from relatives and the child's father. 33% were subjected to various forms of discrimination. None of the single mothers regretted on her decision to save the child, despite the fact that it was difficult. Every single mother needs a psychologist's help. All respondents consider all state benefits and assistance insufficient, they complain about the unfair proportion of the amount of assistance in complete and incomplete families. Only 30% of women have knowledge of their own rights, but they are aware of most social institutions.

In order to find out the market for social services for single mothers, an analysis of the sites of Regional Centers for Social Services for Children, Families and Youth was conducted. The problem was that some of the centers do not have official sites, and information on the content and areas of work is posted on the sites of regional state administrations.

It is established that at present, social services in each regional center implement measures in the field of domestic violence prevention and counteraction, human trafficking counteraction. Centers for work with women, Mother and Child Centers, shelters for the temporary residence of women who have suffered from domestic violence, Advice centers in maternity hospitals, prenatal clinics and baby homes also function in regional centers.

At the same time, specialized agencies were identified in relation to social and psychological assistance to women in general. They are: Center for Assistance to Girls and Young Women in difficult living conditions (Kyiv), Emergency support for young mothers with children and pregnant women (social apartment) (Kyiv), Women's Support Center "Merezhka" (Cherkasy), Center for Women in Crisis Pregnancy (Chernivtsi), Rehabilitation and Prevention of Family Violence Chamber, based on the central district hospital (Zhytomyr), Reintegration Center "Yevgenia" (Women's Information and Consultation Center with the support of Ministry of Health in Zhytomyr), Crisis Center for temporary residence of mothers with children "Mother House" (Vinnytsia); Centers "Woman for Woman", created in Lviv, Donetsk, Dnipropetrovsk, Chernivtsi, Rivne, Zhytomyr and Kherson within the Winrock

International project; Kherson Oblast Center “Successful Woman”; specialized formations created to prevent early social orphanhood through the provision of services for pregnant women and children and so on.

6 Conclusion

The analysis of the results of the survey allowed clarifying single mothers’ social needs and interests and to make suggestions for improving the scope of social services provision and to propose new forms of social support for this category of citizens on this basis. Firstly, according to the fact that social services provision is reviewed on a general basis, women should be separated into certain category by the Law of Ukraine “On Social Services”. Secondly, it is necessary to provide additional measures of social and economic orientation for single parents in the Law of Ukraine “On Ensuring Equal Rights and Opportunities for Women and Men”. Moreover, organizational, content and socio-economic aspects of social services require development and improvement (services in employment, psychological assistance, socio-pedagogical assistance to mothers and their children, opportunities in education and self-education, social services in legal education, leisure, recreation of school age children, medical and social services, issues of upbringing of children with disabilities by single women, etc.). Conditions for involvement of the non-state sector into the social services provision to single mothers should be created. It is also necessary: to expand the range of services aimed at prevention of social orphanhood, the formation of conscious paternity and social rehabilitation; to conduct a broad information policy on the availability of such services; to study foreign experience in order to implement the best practices of social assistance at the local level; to initiate new forms of social support, including special educational courses and single mothers’ training, social rental service, social specialized baby shops, helplines, telephone hotlines, children’s rooms and rooms for babies, courses for future and young mothers, self-help groups, leisure centers at the place of residence, etc.

At the same time, the social protection of single mothers should include the following directions: work of social services with single-parent families; work with single mothers’ surrounding; work with the single mother; volunteer help; social-educational and psychological-pedagogical work with children from single-parent families; social and economic assistance.

References

- Encyclopedia of Social Work. <http://socialwork.oxfordre.com/view/10.1093/acrefore/978019975839.001.0001/acrefore-9780199975839-e-359>
- Sigle-Rushton, W.: England and Wales: stable fertility and pronounced social status differences. *Demogr. Res.* **19**, 455–502 (2008). <http://www.demographic-research.org/Volumes/Vol19/15/>. <https://doi.org/10.4054/demres.2008.19.15>
- Hicks, S.: Social work and gender: an argument for practical accounts. *Qual. Soc. Work* **14**(4), 471–487 (2015)

- Law of Ukraine "On Social Services". <http://zakon.rada.gov.ua/laws/show/966-15>
- Broussard, C.A., Alfred, L., Thompson, J.M.: Stressors and coping strategies used by single mothers living in poverty. *J. Women Soc. Work* **27**(2), 190–204 (2012). https://www.unisa.edu.au/Global/Health/Sansom/Documents/iCAHE/DECD%20journal%20club%20page/Broussard_2012.pdf
- Kiyannitsa, Z.P., Petrochko, Zh.V.: Social work with vulnerable families and children. In: *Modern Landmarks and Key Technologies*, OBNOVA COMPANY (2017)
- Chekhovskaya, I.V.: Social protection of single mothers: analysis of the main positions of the legislation. *Int. Leg. Bull.: Curr. Probl. Present (Theory Practice)* **1**(5), 191–201 (2017)
- Chubuk, R.V.: Applied aspects of social work with incomplete families. *Bull. Chernihiv Natl. Pedagog. Univ. Ser.: Pedagog. Sci.* **142**, 204–207 (2017). http://nbuv.gov.ua/UJRN/VchdpuP_2017_142_47



The New Trends in Research on Social Responsibility of the University

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Abstract. The idea of Social Responsibility of the University has evolved during the last three decades. Due to rapid social and economical changes, relations between higher education institutions and their stakeholders have also changed drastically. Awareness of society and its expectations towards HEIs grew worldwide and a new and deep research project should be established to develop universities' response to societal needs.

Keywords: University · Stakeholders · Trends · Market · Social responsibility

1 Introduction

The idea of social responsibility of a university is relatively young, comparing to social activities of a business sector. In the past two, three decades this idea was not only explored scientifically. It was also implemented by many higher education institutions from around the world.

At the beginning, it was important to analyse if the notion of social responsibility is clear for university leaders. Research results showed a growing understanding and interest in actions that involve stakeholders of the institution. The respondents stated that they were primarily focused on teaching values, creativity, educating a younger generation in accordance with society's and market's requirements. Finally, they concluded that the university is built on an ethical model that works for society [1].

It was obvious then for university representatives to focus on stakeholders – both internal and external ones. As such actions may improve the market positioning and develop their brands, they can directly lead to a better financial performance of the organization. It also corresponds with the conclusion which states that “socially responsible actions of universities are expected by all stakeholders. They also benefit both society and schools. Therefore, such actions should find their implementation in the strategies and missions of educational institutions” [2].

The new research directions on Corporate Social Responsibility have their influence on socially responsible actions of organizations of all types [3]. Also, higher education institutions are experiencing a change in their ‘stakeholders oriented’ strategies. Nowadays, a significant shift is observed in social responsibility studies that are now focused on employee relations, product (or service) quality as well as environmental performance. Some researchers observe an increasing awareness among the

academic community that, for example, aggregated scoring of socially responsible actions need more detailed research [4].

Another interesting topic are the tensions between the university representatives and stakeholders. Both groups should have the same strategic goals, but the reality is worth scientific checking. As the economic performance of every organization is crucial, it is always worth analysing the market's reaction to social activities [5].

The exploration of the issue of compliance versus commitment as motives for engaging higher education institutions in socially responsible activities would be another research topic to develop. In general, the idea of motivation that stands behind actions that go beyond the 'core business' and build a kind of map of specific contingencies to choose from are promising fields to study.

2 New Trends in Research on General CSR

Globalization has a huge impact on the research on CSR. Up until 1990, and even in the year 2010, most of the research, as well as the published data, were obtained from U.S. institutions. But, with the rapid growth of CSR activities and the social awareness of stakeholders, the non-U.S. context became comparable in scale to the U.S. settings. So, now, CSR in universities, as well as in other organizations, should be analysed in the global context only.

Previous research looked at the influence of managers' characteristics, now it deals with corporate ethical behavior (cognitive and motivational conditions that lead stakeholders to evaluate firms' social activities differently). Current projects should try to present a much wider view on the problem of CSR, and the involvement of the organizations in societal-oriented actions, so awaited by stakeholders.

As the report from [6] shows, CSR has become a dedicated function with clear reporting lines into senior executive teams. However, what is the most important, a significant involvement of employees in CSR activities was also observed.

Measuring the effectiveness of CSR efforts is challenging as they are usually difficult to observe. Clearer goals might be helpful. The economic and social changes are yet another challenge, which is not helpful in the situation of limited resources.

All those goals and challenges create a new trend in research of corporate social responsibility [6]. They may be identified as three major ones:

1. Factors that we could call as "antecedent factors", are those that determined organizations to engage in CSR activities and pushed them to more "socially-oriented" actions.
2. Efforts made to examine the consequences of all CSR operations, its outcomes, like measuring the impact on society, its well-being, as well as on the organization's goal achievement, involving the financial ones.
3. Research focused on a better understanding of the process of CSR decision making and its implementation and coherence with the organization' goals. Research of this kind should use the tools of qualitative methods to measure the goals achieved and leverage data access.

In the process of preparing new research projects the main issue that is suggested to be examined is the role of business in society. In comparison to the economic growth, the growth of societal awareness and expectations towards organizations is faster. On the other hand, from organizations' point of view, involvement in CSR activities should, in its final stage, lead to better financial exposure. So, the most vivid subject of research might concentrate on the functionality of mechanisms through which CSR is linked to the financial performance of organizations.

Also, non-financial outcomes should be properly examined. For example, the level of organizational attractiveness for job seekers combined with customer satisfaction. This link is important in creating the expected public presence of the organization.

The way in which the organization predicts its CEO succession along with executives' compensations are also those fields that are worth scrutiny as a way of building proper communications with the internal stakeholders.

In a non-distant future, every organization will be scored on the quality of its employee relations, product quality and environmental performance. The customer dimension and product recall are next. Fighting the risk of fraud should be reported as a socially irresponsible action.

The new area of interest in CSR should be focused on:

- How firms communicate their sustainability commitments,
- Hybridization and hybrid organization as an area of CSR research (organizational actions and field-level conditions influence each other)
- Whether or not firms comply with policy regulations and the consequences of the compliance (also the role of communities in explaining the firm's resistance to regulation)
- How organizations search for and learn from uncertain information (organizations establish close collaborations with regulatory agents to overcome uncertainty following enforcement actions)
- The effect of policy regulations on the firm's resources decisions.

Based on the above, in general, the possible directions of research in future, should be focused on:

- The literature's shift from pondering whether firms should engage in societal challenges to whether and how communities' benefit.
- The interconnections among different stakeholder claims (tensions between shareholders and stakeholders; conflicts among different non-shareholder and stakeholder groups)
- Compliance vs. commitment as motives for CSR (examine tradeoffs under competing goals and conflicts among groups)
- CSR's institutional environment (evolution or change of views on CSR over time within a national context; would the evolution process in an emerging economy follow a similar path as in developed economies; multinational enterprises deal with CSR simultaneously across multiple, diverse institutional environments).
- Dealing with CSR pressure from diverse institutions without sidetracks of socially irresponsible acts

- How individual employees perceive corporate philanthropic acts, especially during difficult financial periods.

Some specific dimensions of CSR gain attractiveness because of the increasing awareness among the academic society that an aggregate CSR score does not say much about the organization's social performance. Anyway, there is much more doubt whether the social dimension has its unique attributes and is worthy of independent scrutiny.

3 The Current State of the System

Internationalization and globalization empowered by new technologies and social media involvement increased competition on both the national and international levels. That is why, universities and colleges are pushed to redefine their missions and visions. In the other words, organizations of higher education must differ from other organizations of this kind and find a new definition and strategy goals explain to their stakeholders the reasons why these organizations were founded. Building a clear and visible differentiation might be helpful to attract new students and also academic staff [7].

Marketing tools, present in every business sector worldwide, have to be used more bravely in the education industry. The creation of a strong brand became crucial also in education. This has led to increased interest in brand creation in the specific context of higher education. Surprisingly, this phenomenon did not meet with wider interest of the academic community [8].

Universities are currently struggling to change to be in line with the stakeholders needs and expectations. As schools play a major role in education and spreading knowledge, they are more active in building relations with society. Changes in the business environment required strongest focus on initiatives related to social responsibility [9].

Social needs lead to social changes. As the university plays a leading role in society it is obvious that as a properly managed organization, it also follows societal trends towards contribution to social welfare. Those actions, together with traditional activities of higher education institutions, put them in leading role in creating global, responsible citizens [10].

Some authors state that universities have a kind of 'contract' with society based on social trust to provide professional knowledge and understanding of the social and economic obligations for society [11].

4 Societal Goals in Higher Education

With the growing role of universities in modern societies the expectations are also prone to grow. Globalization processes require of universities to base their performance on emerging needs of society [12]. Not only the current ones, but also those set in the future [13]. The system of higher education itself is becoming more and more

competitive and institutions react to those changes by reshaping in order to respond to new opportunities and global challenges.

The update of university programs to suit social responsibility goals is of a real necessity in order to achieve a great potential. This action gives a real power to strengthen the marketing arm of the university strategy to obtain a greater market share and a stronger influence on stakeholders.

It is always worth reminding that universities should not be seen only as educational service providers. Institutions of this kind are the shapers identities with major responsibilities to the nation or even to the world [14]. Continuing that idea, it should be said that the crucial role of universities in incorporation of social responsibilities in their missions, visions and strategies – is obvious. Additionally, their actions, such as providing research and curricula, should also be complemented with societal oriented issues [15].

5 Challenges for Universities

Students are precious talent resources of every country. Students' perceptions with regards to social responsibility of the university are a valuable input for universities. Their specific needs show the direction in which educational institutions should go in order to develop social impact and social welfare.

The process of changing the relations between organizations and society is being noticed also by international organizations [16]. The impact of every social organization is crucial for global development. Based on this, universities, as leading organizations, should pay even stronger attention to the prediction of consequences of their actions caused by their strategies or performance.

As social responsibility is in fact an implicit commitment in universities, it may mean that every higher education institution is obliged to spread knowledge in an ethical way as well as preserve a strong commitment to society. The promotion of social responsibility should also be their institutional duty, in order to popularize societal values and behaviour by every member of the university community [17].

One of the most important, also probably the most effective, way of exerting an influence is educational impact, understood as student preparation to being an active promoter of social responsibility of the university. The proper formulation of curricula, implementing social issues in every program, in every course, might be crucial for the expected effect.

In order to do this, new methods and/or frameworks are required. A higher education institution should improve its skills to share the knowledge in order to help students to understand the complexity of the concepts of social responsibility, business ethics, sustainability and their relations with economy and society [18].

There are a few factors for universities to consider if they want to play a role as a responsible partner for and with society [17]:

- Universities are responsible for the education of managers; going from 'being the answer to being a part of the problem'.

- Implementing a social management of knowledge by applying interdisciplinary research projects to create synergy of knowledge.
- Promote joint learning communities for sustainable development to increase social impact to every social group.

6 New Trends on Social Responsibility of the University

As results of empirical research in a self-report study with a total sample of 400 undergraduate students of the University of Leon, Spain, shows, the students' awareness of social responsibility of the university is on the increase and represents a growing interest in the subject. On the other hand, the university actions in the field of social responsibility should become an essential tool for higher education institutions.

The suggestion that social responsibility of the university can be seen as a marketing strategy focused on gaining better understanding of the students' needs can also be helpful to empower the university's brand, is also the result of another research project. Representatives of universities from Poland as well as from more than 100 countries, confirmed that [2].

Another study focuses on the way 684 Portuguese academics and 64 employers perceive the responsibility of different higher education stakeholders for developing graduate employability. That research project was conducted eight years after the implementation of the Bologna Process, which, in Portugal, focused on employability [19].

Universities as other large organization are inseparable from various stakeholders, and therefore have to be managed in accordance with their expectations. A dialogic reporting culture with stakeholders should be developed in higher education accounting [18].

A case from Lithuania presents their commitment in social responsibility. The research conducted on 12 out of 14 public universities in that country analyzed their annual performance reports. The results showed that it is not common practice to publish separate reports on their strategy of social responsibility and its implementation in Lithuanian public universities. It is worth mentioning, that the results obtained allowed to show that two out of fourteen Lithuanian public universities belong to the Global Compact network and have their own commitments to implement socially responsible principles and report their progress to the United Nations Agenda Global Compact [20]. One might expect that, in future, separate reports on social responsibility in universities and their sustainability will be published.

A more practical contribution of that project might be to screen the current situation of Lithuanian public universities in the area of sustainability reporting. The results obtained may be useful in comparative research to analyze reporting practices among different universities (and/or higher education institutions) from different countries and regions, and also to improve sustainability reporting in future [20].

7 Conclusions

The new area of interest in general CSR should be focused on:

- How universities communicate their sustainability commitments
- Hybridization and hybrid organization as an area of CSR research (organizational actions and field-level conditions influence each other)
- Whether or not universities comply with policy regulations and the consequence of compliance (also the role of communities in explaining HEIs' resistance to regulation)
- How organizations search for and learn from information under uncertainty (organizations establish close collaborations with regulatory agents to overcome uncertainty following enforcement actions)
- The effect of policy regulations on firm resource decisions

Based on the above, in general, the possible directions of research in future should be focused on:

- The literature's shift from pondering whether HEIs should engage in societal challenges to whether and how communities benefits. It shows a much stronger power on the stakeholder side of the relation.
- The interconnections among different stakeholder claims (tensions between students and university staff; conflict among different stakeholder groups).
- Compliance vs. commitment as motives for socially responsible actions (examine tradeoffs under competing goals and conflicts among groups).
- CSR's institutional environment (evolution or change of views on CSR over time within a national context; would the evolution process in an emerging economy follow a similar path as in developed economies; multinational enterprises deal with CSR simultaneously across multiple, diverse institutional environments)
- Dealing with CSR pressure from diverse institutions (e.g. lawmakers, regulators, evaluation bodies, etc.) without sidetracks of socially irresponsible acts.
- How individual employees perceive universities' socially oriented acts, especially when HEIs are, in public opinion, underfinanced.

Also, further research on social responsibility of the university should, in fact, refer to previous research results in that matter. One of the first questions to be asked to respondents should be about how they understand the notion of social responsibility of the university and in what way they connect this term with the relation between higher education institutions and their stakeholders.

New research directions on Corporate Social Responsibility have their influence on socially responsible actions of organizations of all types. Also, higher education institutions are experiencing the change in their 'stakeholders oriented' strategies. It is combined with the growing awareness among academic staff that aggregated scoring of socially responsible actions needs more detailed research.

Another interesting topic is to analyse if any tensions between university representatives and stakeholders are observed. Both groups should be in line about their strategic goals, but the reality is worth scientific checking. As the economic

performance of every organization is crucial, it is always worth analysing the market reaction to social activities [5].

The exploration of the issue on compliance versus commitment as motives for engaging of higher education institutions in socially responsible activities would be another direction for further research topics to develop. In general, the idea of motivation that stands behind actions that go beyond the ‘core business’ and build a kind of map of specific contingencies to choose from is promising field to study.

References

1. Geryk, M.: Social Responsibility of the University as Perceived by its Stakeholders. Research Report, Warsaw School of Economics, Warsaw, p. 131 (2011)
2. Geryk, M.: Social Responsibility of the University, Gdansk Management College, p. 307, Gdansk (2016)
3. Wang, H., Li, T., Riki, T., Gerard, G.: Corporate social responsibility: an overview and new research directions. *Acad. Manag. J.* **59**(2), 534–544 (2016)
4. Agunis, H., Glavas, A.: What we know and don’t know about corporate social responsibility: a review and research agenda. *J. Manag.* **38**(4), 932–968 (2012)
5. Flammer, C.: Corporate social responsibility and shareholder reaction: the environmental awareness of investors. *Acad. Manag. J.* **56**(3), 758–781 (2013)
6. Wang, H., Tong, L., Takeuchi, R., George, G.: Corporate social responsibility: an overview and new research directions. *Acad. Manag. J.* **59**(2), 534–544 (2016)
7. Chapleo, C., Duran, M.C.V., Diaz, A.C.: Do UK universities communicate their brands effectively through their websites? *J. Mark. High. Educ.* **21**(1), 25–46 (2011)
8. Beerli, P., Diaz, G., Perez, P.: The configuration of the university image and its relationship with the satisfaction of students, *J. Educ. Adm.* **40**(5), 486–505. Based on: Chapleo, C., Duran, M.C.V., Diaz, A.C.: Do UK universities communicate their brands effectively through their websites? *J. Mark. High. Educ.* **21**(1), 25–46 (2011)
9. Dima, A.M., Vasilache, S., Ghinea, V., Agoston, S.: A model of academic social responsibility. *Transylv. Rev. Adm. Sci.* **9**(38), 23–43 (2013)
10. Marinescu, P., Toma, S.G., Constantin, I.: Social responsibility of the academic level. Study Case: The University of Bucharest. *Stud. Sci. Res. Econ. Ed.* **15**, 404–410 (2010)
11. Boden, R., Nedeva, M.: Employing discourse: universities and graduate ‘employability’. *J. Educ. Policy* **25**(1), 37–54 [p. 38] (2010)
12. Núñez Chicharro, M., Alonso Carrillo, I.: La responsabilidad social en el mapa estratégico de las universidades públicas. *Pecunia.* **9**(13), 157–180 (2009)
13. Setó-Pamiés, D., Domingo-Vernis, M., Rabassa-Figuera, N.: Corporate social responsibility in management education: current status in Spanish universities. *J. Manag. Organ.* **17**(5), 604–620 (2011)
14. Sullivan, W.M.: The university as citizen: institutional identity and social responsibility. A special report. *Civ. Arts Rev.* **16**(1), 1–14 (2003)
15. Muijen, H.: Corporate social responsibility starts at university. *J. Bus. Ethics* **53**(1–2), 235–246 (2004)
16. European Commission: A renewed EU strategy 2011–2014 for Corporate Social Responsibility. <https://eur-lex.europa.eu/legal-content/EN/TXT/?uri=CELEX%3A52011DC0681>
17. Vázquez, J.L., Aza, C.L., Lanero, A.: Are students aware of university social responsibility? Some insights from a survey in a Spanish University. *Int. Rev. Public Non-Profit Market.* **11**, 195–208 (2014)

18. Audebrand, L.K.: Sustainability in strategic management education: the quest for new root metaphors. *Acad. Manag. Learn. Educ.* **9**(4), 413–428 (2010)
19. Sin, C., Amaral, A.: Academics' and employers' perceptions about responsibilities for employability and their initiatives towards its development. *High. Educ.* **73**, 97–111 (2017)
20. Dagiliene, L., Mykolaitiene, V.: Disclosure of social responsibility in annual performance reports of universities. *Procedia Soc. Behav. Sci.* **213**, 586–592 (2015)



Investigation on the Value Judgment Criteria of Customized Garment Products by Mass Consumers

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Abstract. In 2016, the space scale of mass customization market in China is 10.22 billion RMB. The customization market is growing rapidly. It is expected to reach 200 billion RMB by 2020, which will be a huge consumer market. In 1954, marketing scientist Drucker pointed out what customers buy and consume is not the product, but the value. In the consumption process, Consumers meet the needs of the subject value through the object of the value of the property in the custom clothing products. However, in the current research results, there are many contents about the types and production modes of customized clothing brands, but few contents about consumer demand and the judgment criteria of consumer value. So, in order to have a clearer understanding of contemporary Chinese customized clothing consumers' judgment criteria for the value of clothing products. On the basis of the previous research, this study drew up 24 issues related to the value judgment of apparel products, which are mainly divided into two parts: the value needs of the value subject and the value attributes of the value object. Through the network questionnaire, 169 survey samples were received. The results show: 1. Contemporary Chinese mass consumer groups have the desire to consume customized clothing, but not strong; 2. There are obvious differences in demand among different value subjects; 3. Among the current value demand of clothing design, the most important is the practical demand for customized clothing, namely, the tailored clothing, one-person-one-edition, and the practical function suitable for their own characteristics; 4. The social demand for customized clothing is weakened, and people's attention to value has changed from other people's evaluation to self-recognition. This is not consistent with Maslow's hierarchy of needs theory, but also worth thinking about. 5. People's desire for cultural demand, emotional demand and personal development demand is basically the same.

Keywords: Custom clothing · Mass consumers · Product value · Value criteria

1 Introduction

After the 21st century, China's garment industry has undergone tremendous changes. The main phenomena include: the change of the garment industry foundation, the formation of buyer's market and the serious overproduction of ordinary garment

products, the obvious diversification and individualization of customer demand, and the rapid elimination of garment and the technological progress of garment industry have resulted in the shortening of product life cycle (Yang et al. 2007). With the development of domestic economy, the per capita disposable income has been raised, and the living standard has also been improved. Domestic consumer groups have been divided, and the high-consumption groups have been growing, cultivating the special customized soil. The continuous development of domestic clothing has laid the foundation for further development of customized market (Liu 2008). An important feature of garment market development is the design strength and the surge in demand for product design. According to statistics, in 2016, the space scale of China's mass clothing customization market was 10.22 billion RMB, and the customization market showed a rapid growth, which is expected to reach 200 billion RMB by 2020. Fashion design has developed rapidly, and the era of individualization has come. With the improvement of education level, people's cognitive level and aesthetic concept have changed greatly. Especially after 1990, people are constantly innovating and pursuing self-concept. People's demand for clothing is no longer only the basic function, no longer passively accepting the idea and mode of popularization, but more of its significance. Needs become a representation of self-state of mind. Through different standards of dress mental state, gradually meet the personalized personality of different styles (Zhu and Li 2016). Customized design is carried out according to their own characteristics and thinking mode. One obvious feature in this period is that consumers participate in the whole process of costume design, production and value realization (Ning 2012). The above research results indicate that there is a positive correlation between the development of customized clothing and mass consumption demand, but there is a lack of consumer demand and the content of consumer value judgment criteria.

Peter F. Drucker pointed out in 1954 that customers buy and consume not products, but values. Value is defined by the customer. The primary role of management, therefore, is to create demand by providing innovative solutions to customers' pain. Consumers meet the value needs of the subject through the value attributes of the object in the process of customizing clothing products. So, what are the value needs of mass consumers in customized clothing consumption? What are the criteria and levels of contemporary value judgment? These are the main problems of this paper.

2 The Relation Between the Value Demand of the Subject and the Value Judgment of the Product

Whenever we ask questions like "What should we do", we go beyond facts and scientific theories and look for a value judgment (Binkley 1969).

2.1 Principle of Subjectivity in Value Judgment

Human needs exist objectively and are subjectively affected (Liu 2012). Value is a general category of relationships. In this relationship, whether the object meets the needs of the subject according to the scale of the subject, whether it has a positive effect

on the survival, development and perfection of the subject, and plays a key role in the generation of value and the size of its value. In this sense, value is the object's affirmation or negation of the subject's needs and is the process and result of the value of the object's attributes (Hu 2000). In the process of customized clothing consumption, consumers' value judgment of customized clothing has become an important factor affecting their consumption concept and behavior. When people choose or judge whether a garment is purchased or not, they are based on certain value criteria. In fact, it is a kind of value judgment. It is a process of recognizing, identifying and expressing the choice intention of all kinds of garment products and services. In this process, the object (customized clothing) provides not only clothing to the main body (consumers), but also all the value connotation provided by the object (customized clothing), which is the process of matching the needs of the main body and the attributes of the object. In the process of value thinking, value judgment becomes a result of interaction between subjects in the process of value cognition completion. Value judgment is an evaluation of the subject's theoretical and conceptual level. It is the subject's determination of the value relationship between a certain object and subject according to certain evaluation criteria (Sun 2008). It is precisely in the preceding context that we emphasize that the subject's needs are the internal basis and the main criterion of value judgment (Chen 2005). In fact, people's value judgment of objective things is not only a rational analysis of the existence of objective facts, but also a perceptual judgment from the emotional and subjective needs, which has become the main basis for the formation of the value judgment standard of customized clothing products. Since value judgment is related to people, the criterion of judgment must be a criterion with judges in it, that is to say, subjectivity in the criterion of judgment.

2.2 Multidimensional Characteristics of Value Judgment

“Not only does each of us value the same things differently, we individually value different things, and at different times in different ways” (Woodall 2003). The value needs of consumers have distinct multi-dimensional and dynamic characteristics. The measurement of perceived value is inconsistent (Gallarza and Gil 2006). In this sense, people have reached a consensus on the multidimensional and dynamic nature of the concept of value (Sweeney and Outar 2001), accepting the existence of several explanatory factors that allow the measurement of perceived value. Value perception and attribution vary between individuals and situations: “Each of us has different values not only for the same thing, but also for different things.” For example, the existence and value of the same pair of shoes are objective, but different human needs lead to different value content for different people. In daily life, people always weigh, compare and choose the objective things from the standpoint, angle and preference of the judges. Here, it weighs the meaning of the judges to people. In different periods, people may change their judgment criteria for specific things, but there will be relatively stable parts in the deep level. This is the multi-dimensional and dynamic characteristics of judgment criteria.

2.3 Multiple Levels of Value Judgment

The level of value judgment mainly includes two aspects: simple value judgment and compound value judgment. Simple value judgment means that from the point of view of human biological characteristics, human beings have the instinct to seek valuable goals for their existence and meet their own needs. Compound value judgment, that is, from the perspective of human social characteristics, after human-led creation, more pursuits tend to abstract and complex goals. This is the formation mechanism of compound value judgment. Simple value judgment, which is based on basic value, belongs to the judgment at the cognitive level, and often directly determines the true and false behavior through experience. Similar to Descartes' criterion of "clear and clear" truth, it has more advantages of clarity and simplicity from the perspective of application. Experience is based on long-term practice and work, summarized from the activities of skills and perception. Philosophical point of view refers to the direct reflection of objective things from the subjective level based on long-term research or frequent contacts, but it needs to be pointed out that the cognitive level is a rough reflection on the unprocessed basis. For example, "clothes keep warm" and "this scarf looks good" are simple value judgments. Compound value judgment refers to a higher level of value judgment formed by logical combination of several simple value judgments according to certain rules. This type of value judgment is not directly made and carried out by human experience. For example, "this suit looks like an entrepreneur" or "this skirt has an artistic feel" are complex value judgments. This kind of judgment needs the experience accumulation and knowledge reserve of the judges to a certain extent, and forms a compound concept before the evaluation can be made. In such judgments, people must form a formal cognition of "clothing", "entrepreneur" or "art" as the premise of compound value judgment. There is a hierarchical relationship between simple value judgment and compound value judgment, which is the premise and foundation of compound value judgment.

3 Research Hypothesis

3.1 Assumption of Subject Requirements

By comparing Maslow's demand theory (1960) we can see the different levels of clothing needs: in the level of physiological needs, people need clothing with basic functions such as cold resistance, warmth, shame, shelter, etc., which can meet the basic physiological protection. For example, underwear, raincoat, down jacket, etc. In the level of security needs, people need protective clothing, which can meet the needs of occupational safety and personal safety. For example, work clothes, fire-fighting clothes, work gloves, etc. In the level of social needs, people need clothes with social characteristics, fashion and other functions, in line with the mainstream trend of social aesthetics and culture, and dressers seek the main body identity of society. For example, fashionable clothing; in the level of respect for demand, people need clothing with artificial classification and class differences, people can express their taste and identity through clothing. For example, international well-known brand clothing brand has been artificially divided into first-line brand and second-line brand; in the level of

self-realization demand, people need to give full play to their potential, tend to their ideal image of clothing, it can show individuality, difference, with personal unique symbols. For example, advanced customization, Limited Edition clothing, etc. (Fig. 1). From Maslow's demand theory, it can be seen that the highest customized experience is the emotional expression of self-realization, which expresses its potential in the most effective and complete way. However, the establishment of all theories has its corresponding era background and historical factors and has certain timeliness. With the changes of people's environment, thinking mode, concept consciousness, behavior mode and other factors, the demand level and characteristics of contemporary people are quite different from those of the 1960s. Therefore, the study of the main demand of customized garment product value must be emphasized. Through cross-comparison of literature, this paper assumes that the main needs are six kinds: instinctive needs, social needs, cultural needs, emotional needs, enjoyment needs and development needs.

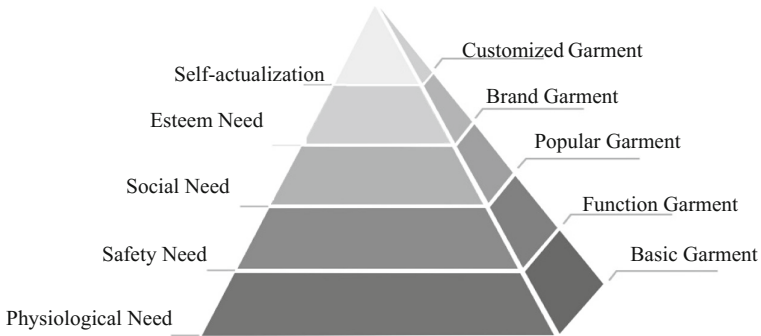


Fig. 1. Clothing demand hierarchical contrast diagram

3.2 Assumption of Value Judgment

The formulation of value judgment criteria does not mean the recognition of general functions, forms and styles, but highlights its value significance. Therefore, the formulation of value judgment criteria for customized clothing products needs to select the dominant and dominant value in the process of customized clothing consumption from a number of values.

In *“Introduction to the Philosophy of Value”*, Ma lenko divides value into three kinds: human value, material value (natural value and economic value), spiritual value (knowledge, morality, aesthetics, religious value). In Max Scheler's value system, value is divided into eight distinct “categories”. They are intrinsic and other people's values, people's and thing's values, self-induced values, thoughts and actions' and results' values, actions and Reactions' values, intentions and states' values, foundations or relationships' values, individuals and groups' values. Value. These methods have different classification results because of different dominant classification methods. In the article *“Re-setting the Benchmark of Product Design Value Evaluation”*, all the value elements are clustered and integrated, and 97 different categories including utility, safety, utilization, regression, aesthetics, sociality, times, regionality, economy,

commodity and popularity are obtained. Then the KJ method is used to combine different researchers' different understanding of the design elements. Summarize and classify these value elements, and finally get five types of value elements: aesthetic value, functional value, economic value, creative value, environmental value. In the retail sector, Sweeney and Outar (2001) developed a scale to measure perceived value. The universal scale defines three basic dimensions of value: emotional value (emotion generated by products), social value (utility derived from products' ability to enhance consumers' social self-concept) and functional value. Satisfaction of value needs is a clear predisposing factor for consumption (e.g., Vieira 2010; Sharma et al. 2012; Gallarza et al. 2013; TSAO 2013; HSUA et al. 2015). Values based on self-orientation can bring satisfaction. Value orientation includes: H3 (H3a) excellence value, (H3b) efficiency value, (H3c) entertainment value, (H3d) aesthetic value of retail experience (Moliner-Velázquez 2018).

In this questionnaire, we conducted a preliminary classification of the value orientation of customized clothing products based on the value demand of the main consumer of mass clothing and through the cross comparison with the product value classification. Set includes: natural value, instrumental value, practical value, symbolic value, technical value, knowledge value, social value, aesthetic value, economic value, cultural value, ethic value, ecological value, political value, harmony value, development value and negative value of 16 items. It also as the value subject in the clothing design of the main sources of value judgment standard.

4 Investigation and Research

4.1 Research Objects and Methods

In order to have a clearer understanding of the product value of customized clothing, the author conducted a questionnaire survey through the Internet and face-to-face interviews. 200 questionnaires were sent out and 180 were returned, among which 169 were valid. Table 1 shows the main research frameworks.

Table 1. Technical details of quantitative research

Item	Content
The main object	Clothing consumer
Geographical scope	China
Sample size	169 consumers
Sample method	Stratified random sampling
Data collection period	October–November 2017
Statistical techniques	Descriptive analysis Exploratory factor analysis
Statistical software	IBM SPSS statistics 22

To accurately judge the purpose of people's use, it is essential to study the "people" within the scope of specific society, specific era, specific environment, specific conditions and specific time, so as to realize the needs of such a very specific person. This research takes "Maslow's demand" as the theoretical origin and combines different characteristics of current consumption trends. Based on the previous research, 24 questions related to the value judgment of clothing products are drawn up. The research content is divided into two parts: the value demand of the consumer and the value attribute of the value object. In the survey on "the value needs of consumption subjects", it is assumed that respondents (consumption subjects) have six value needs: instinct needs, social needs, cultural needs, emotional needs, enjoyment needs and development needs. And decomposed into 18 small topics, including style, version, aesthetic, pattern, fabric, social needs, conformity needs, feel pleasure, vent emotions, enjoy services, seek development and other content, to explore the in-depth needs of contemporary value subjects. On the value of "value object attributes" survey assumes that the value of custom clothing (object) attribute contains 16 different value: natural value, instrumental value and practical value, symbolic value, technical value, knowledge value, social value and aesthetic value, economic value, cultural value, the ethic value, ecological value, political value, the harmony value and development value and negative value. And decomposed into 36 small questions, respectively from the consumption before, in, after the analysis of the correlation between consumer behavior and value attributes (Table 2). The questionnaire design includes four parts. The first part is the survey on the respondents' basic information, consumption behavior, consumption awareness and the status quo of customized clothing. The second part is the investigation of the respondent's value demand. The third part is the investigation of the respondent's value orientation in customized clothing products. In the fourth part, the behavior of the respondents in the customization process is investigated.

Table 2. A preliminary classification of the value attributes of customized clothing products

Value attributes of clothing products	Content
Natural value	Natural attributes of consumer goods
Instrumental value	It has the value of helping users understand themselves better and realize self-design
Practical value	It has practical functions and can help users realize the value of specific functional requirements
Symbolic value	It has the function of symbolic symbols, representing the value of an image or becoming a personal symbol
Technical value	It has prominent technical advantages, meets users' needs in terms of technology, promotes the improvement of clothing design and production technology, and promotes the value of clothing equipment improvement
Knowledge value	It has the value of original knowledge dissemination and promotes the diffusion of clothing-related knowledge

(continued)

Table 2. (continued)

Value attributes of clothing products	Content
Social value	It has the value of reflecting contemporary Chinese consumption concept, consumption level and social structure
Aesthetic value	It has the value of beauty in form, shape, color, material and craftsmanship in line with the aesthetic concept of contemporary Chinese consumers
Economic value	It has a high cost-effective value
Cultural value	It has the value of creating an idealized image, displaying cultural characteristics, inheriting traditional culture and showing a certain way of life
Ethic value	It has the value of being people-oriented and adapting to different conditions
Ecological value	It has the value of sustainable development, pollution reduction and environmental protection
Political value	It has the value of political identity and image
Harmony value	It has the value of harmony with natural environment, social environment and interpersonal communication
Development value	It has the value of benefiting macro and micro environment
Negative value	It is a value guided by complete personal interests

4.2 Research Results

In this survey, the age distribution of respondents is basically normal, in which the proportion of 31–40 years old is 49.1% at most. Teachers, students, designers, sales personnel, management and technical personnel, the largest proportion of teachers is 29.59%; Clothing, textile, education and real estate-related industries dominated, with the largest proportion of 34.32%; The distribution of the annual income above 30,000 is normally distributed, and the proportion of 50,000–100,000 is 29.59%. The distribution of academic qualifications also presents a normal distribution, in which the proportion of undergraduates and postgraduates is the largest (both 39.05%), which may be caused by the large proportion of students. The proportion of consumers' expenses on clothing presents a normal distribution, which corresponds to the distribution of annual income above 30,000 RMB indicating that the higher the income of consumers, the more expenses they spend on clothing.

Through statistical analysis of the significance, average equality and t-value test of the survey data, the results show that:

(1) The value demand of the consumer

- homogeneity of variance of male and female ($F_{sig} = 0.411$), assuming equal variance, the corresponding t value of $0.266 < 3$, indicating little difference, and significance (double-tailed) of $0.790 > 0.05$, indicating no significance. Therefore, gender has no significant influence on value theme demand.

- the degree to which the value subjects are required at different age levels, with the highest requirements for 18–25 years, with minimum requirements of 51–60. The corresponding standard deviations are relatively small, indicating that the overall fluctuation of value subject demand in different age groups is not large. By further one-way anova, its significance value was 0.346 (significantly greater than 0.05), indicating that there was a difference in value subject demand among different age groups, but it was not significant. This data shows that age has no significant influence on value subject demand.
- there is little difference in the needs of value subjects among different income groups. Among them, the standard deviation of more than 1 million is relatively large, indicating that their demand for value subject has relatively large volatility. According to one-way anova, the significance of 0.959 was significantly greater than 0.05, indicating that there was no difference in the demand for value subjects among different income groups.
- there is no difference in the needs of value subjects among different educational groups.
- there are significant differences between different subject requirements. The average value of instinctive value demand is the highest at 3.715. In addition, the significance in one-way anova was 0.000, which was obviously less than 0.05.

Because there are significant differences between different subject requirements, it is compared in pairs. Through comparison, it is found that there is a significant difference in value orientation between instinctive demand and all other demands, and there is also a significant difference between social demand and all other demands. In addition to the significant difference between general subject demand and instinctive demand and social demand, there is no significant difference between average value and other demands. This shows that cultural needs, emotional needs, enjoyment needs, and development needs are at the same level with the main body needs. However, as can be seen from the average value graph of different demands (Fig. 2), the average value of instinctive demands is the largest, the average value of social demands is the smallest, and other main demands are in the middle. Since the average value of social demand and instinctive demand is the maximum and minimum respectively, the correlation between them is analyzed. The analysis results show that there is no correlation between them, which indicates that instinctive demand and social demand are two independent demand levels, while other subject demand and total subject demand are in the middle of their instinctive demand and social demand, which is another level.

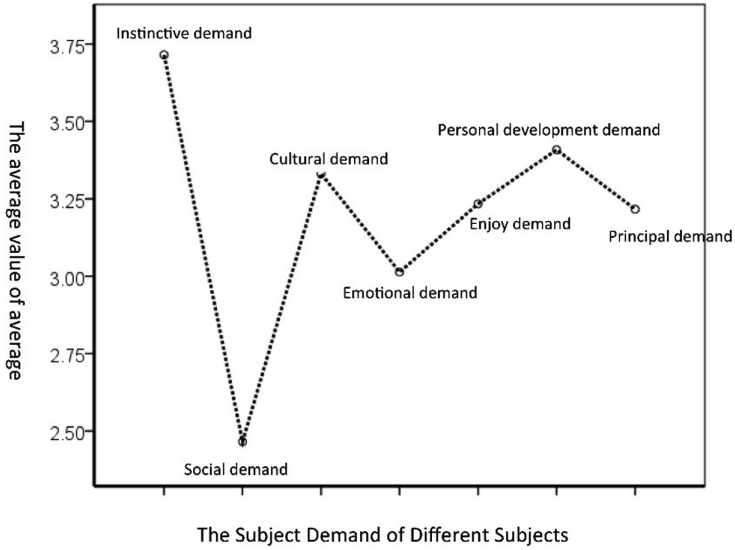


Fig. 2. The subject demand of different subjects.

(2) The value attribute of the value object

The mean value and standard deviation of different value orientations have the highest mean value of 3.7870, and the standard deviation of natural value and political value is relatively large, indicating that the fluctuation range is relatively large. The average value directly reflects the differences between different value orientations and types. In order to further analyze the significance of the differences, it can be seen that the significance value of the univariate variance of different value orientations and types is $0.00 < 0.05$, indicating that there is a significant difference between different value orientations and types.

Through multiple comparisons of different value attributes and types, it is found that only harmonious value, negative value and general value orientation are significantly different. There is no significant difference between other value attributes and total value attributes. According to mean value Fig. 3 and load Fig. 4, ecological value, political value, harmonious value, development value and negative value can be regarded as one level, while other value attributes and types can be regarded as another level and be consistent with the total value attributes and types. After analyzing the single-factor variance of different genders to the ecological value and other value attributes and categories, it is found that there is no significant difference between different genders in the ecological value and other five value attributes and categories. Similarly, the analysis of other basic information on the mean one-way variance of the five value orientations also found no significant difference.

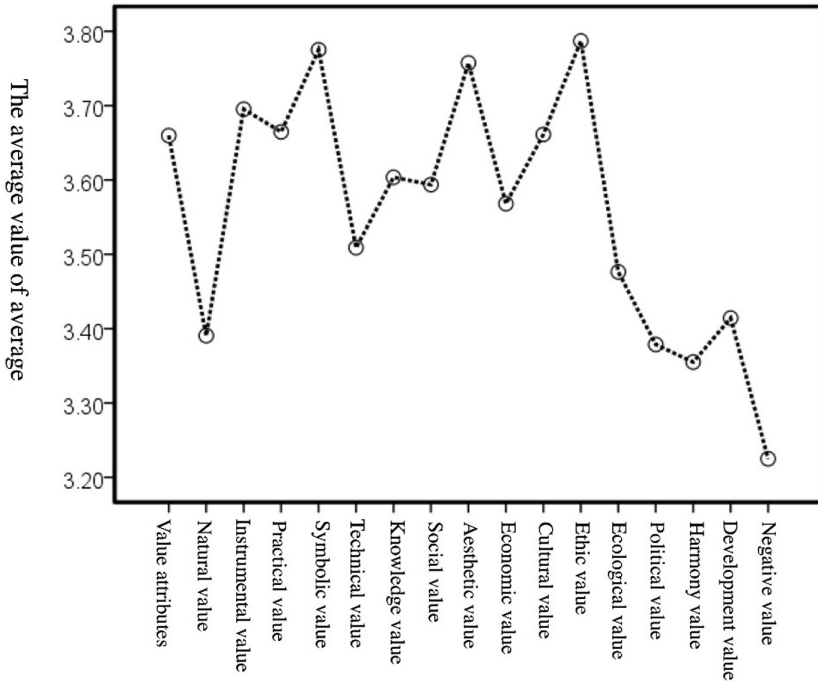


Fig. 3. Average graph of different types of value attributes

Rotating Spatial Component Diagram (Load Diagram)

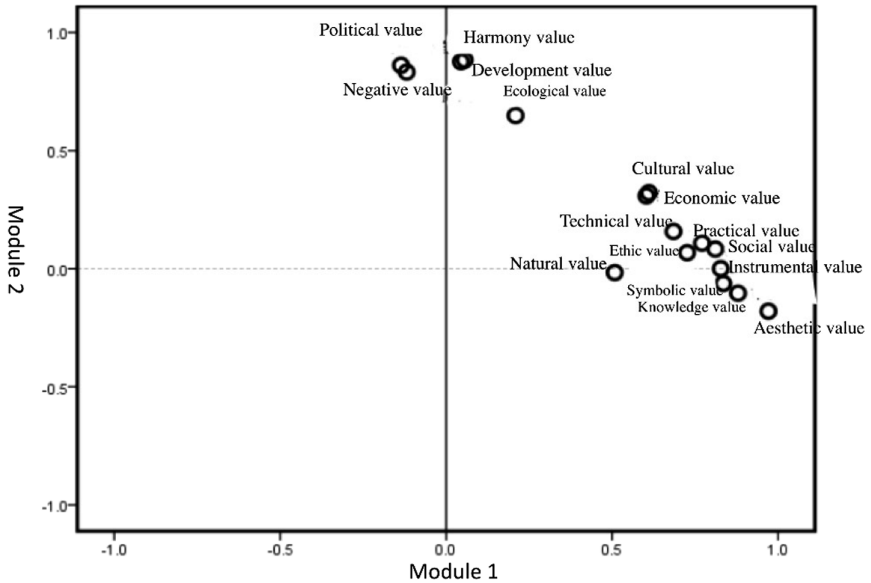


Fig. 4. Rotating spatial component diagram (load diagram)

5 Conclusion

Through the analysis of the results of the main demand part of the questionnaire, the following conclusions can be drawn: (1) The mass consumer groups in contemporary China are willing to consume customized clothes, but not strongly; (2) The different value subjects have obvious differences in demand; (3) The most important aspect of the value subject in the current fashion design of the design, is also the practicality of the custom clothing, which is the quantity of custom clothing, one version of the clothing, and the functional function of the individual characteristics; (4) On the contrary, the social demand brought by customized clothing is weakened. People's attention to value has shifted from others' evaluation to self-recognition, which is not quite consistent with Maslow's hierarchy of needs theory and also worth thinking about. (5) People's desire for cultural needs, emotional needs and personal development needs is basically the same.

After analyzing the investigation results of the attributes of customized clothing products, the judgment basis, standards and levels are gradually expanded, and the following conclusions can be drawn after cross comparison with the main demand: (1) People's value judgment on objective things is not only a rational analysis of the existence of objective facts of things, but also a perceptual judgment of emotions and subjective needs, which has become the main basis for forming the value judgment standard of clothing design. (2) From the perspective of the main factors that influence the understanding of the value of customized clothing products, the standards of product value judgment are determined as follows: moral and ethical standards, cultural and artistic standards, social living standards, and ecological and environmental protection standards. (3) From the perspective of the mechanism of value judgment, customized product value of 15 kinds of attribute value (the analysis here do not include negative value), the aesthetic value, natural value and instrumental value, practical value can be through the sensory experience to gain understanding of custom clothing products belong to the simple value judgment, and symbolic value, knowledge value, social value and ethical value, technical value, economic value, cultural value, ecological value and development value, political value, the harmonious value, is basic value judgment must be based on the accumulation of experience, to make the composite value of the judgment. (4) The judgment on the value of customized clothing products is the composite value judgment based on the basic value judgment of the value subject, and the unity of the multiple needs of the subject on the basis of meeting the basic survival needs. The design value judgment first comes from the judge's personal value judgment, which is the natural "for me" tendency of human beings, and then comes from the social value judgment, which is rational and common judgment.

Of course, this subject can also be divided into different regions, different groups and different classes. At present, the research framework is only preliminarily completed, and there is still much more to be done in the future.

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References

- Yang, Q., et al.: *Mass Customization of Clothing*, pp. 34–35. China Textile Press, Beijing (2007)
- Liu, L.: Concept analysis and current situation analysis of Chinese fashion customization. *Art Des.* **08**, 207 (2008)
- Zhu, X., Li, J.: Research on clothing design for personalized customization. *West. Leather* **2**, 26 (2016)
- Ning, B.: Market research on China's "clothing customization studio". *Yihai* **05** (2012)
- Drucker, P.F.: *The Practice of Management*. HarperCollins, New York (2010)
- Liu, G.: *Xiang wai ji*, 1st edn., 139 p. China Construction Industry Press, Beijing (2012)
- Sun, W.: *Methodology of Value Philosophy*, 1st edn., 291. China Social Science Press, Beijing (2008)
- Chen, C.: The rationality of subject demand is the criterion for the rationality of value judgment. *J. Hubei Univ. (Philos. Soc. Sci. Ed.)* **05**, 253 (2005)
- Woodall, T.: Conceptualising 'value for the customer': an attributional, structural, and dispositional analysis. *Acad. Mark. Sci. Rev.* **7**(12), 1–42 (2003)
- Aminia, P., Falk, B., Hotha, N. C., Schmitt, R.: Statistical analysis of consumer perceived value deviation. *3rd ICRM 2016 Int. Conf. Ramp-Up Manag.*, 1–6 (2016)
- Li, D.: Several questions about value. *J. Party Gov. Cadres* **3** (2008)
- Sun, Z.: Reconstruction of value philosophy: starting from value judgment. *Mod. Philos.* **01** (138), 25 (2015)
- Moliner-Velázquez, B., Fuentes-Blasco, M., Servera-Francés, D., Gil-Saura, I.
- Shi, C.: Research on the integration of value judgment and value behavior. *Chin. Leadersh. Sci.* **09**, 45–47 (2017)
- Ruiz-Molina, M.E., Gil-Saura, I.: Perceived value, customer attitude and loyalty in retailing. *J. Retail. Leis. Prop.* **7**(4), 305–314 (2008)
- Hara, T., Shimad, S., Arai, T.: Design-of-use and design-in-use by customers in differentiating value creation. *CIRP Annals.* **62**(1), 103–106 (2013)
- Potra, S., Pugna, A., Negrea, R., Izvercian, M.: Customer perspective of value for innovative products and services. *Procedia Soc. Behav. Sci.* **238**, 207–213 (2018)
- Asshidin, N.H.N., Abidin, N., Borhan, H.B.: Perceived quality and emotional value that influence consumer's purchase intention towards American and local products. *Procedia Econ. Financ.* **35**, 639–643 (2016)
- Zhong, K.: Subject demand and value evaluation. *Jianghai J.* (5) (1994)



Host Country Nationals' Perceptions of Expatriates and Social Support: Does Host Country Nationals' Position Matter?

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Abstract. Studies have acknowledged the unique role of host country nationals in the expatriation process as they often play a critical role in expatriate assignment success. However, the association between host country nationals' perceptions of expatriates and social support has not been thoroughly investigated in the expatriation literature. In addition, little is known about how the position occupied by host country nationals influence their inclination to support expatriates. This study empirically examines the effects of host country nationals' perceptions of expatriates on social support in sub-Saharan Africa host nation using the mixed methods research approach. The results of the study revealed that host country nationals' perceptions positively influenced social support. Openness and expatriate privileges are significantly associated with social support. Results suggest that expatriate position may either strengthen or weaken host country nationals perception-social support relationships.

Keywords: Perceptions · Host country nationals · Social support · Expatriates

1 Introduction

Expatriate adjustment and assignment success has occupied the attention of international human resource management researchers over the past decades. The capacity for expatriates to become more effective and productive in host subsidiaries of multinational companies greatly depends on their cross-cultural adjustment to the host country. Cross-cultural management researchers maintain that cross-cultural experiences and cross-cultural competence are positively related to effective expatriate work performance in diverse cultural environments [1–3]. For instance, a longitudinal data obtained from 70 expatriates on international assignment, working for a large multinational Global 100 company in the energy industry reported that cross-cultural motivation and psychological empowerment have a significant positive effect on the initial levels of work adjustment of the expatriates [4]. Accordingly, the most commonly mentioned reason for expatriates' premature return and failure is a lack of cross-cultural adjustment to the host country [5–8].

Work adjustment has a significant positive relationship with expatriates' attitudes toward work and their overall effectiveness [4]. Hence, the inability of expatriates to

familiarise and appreciate the culture of the host country can have a negative impact on their interactions with host employees and affect performance outcome. As a result, cultural-fit researchers maintain that the extent to which there exist similarities between the personal values, beliefs and personality traits of the expatriates and the host countries, the more likely their safety and comfort will be significantly enhanced [9–12]. Researchers in international human resource management (IHRM) acknowledged that expatriates' failure is not only a source of personal concern to the international assignees themselves but can also have a negative impact on companies' competitive advantage in the global market [13, 14]. Although expatriates play a significant role in the achievement of organisational objectives, the impact of international assignment on the expatriates and their families can be enormous [15, 16]. The failure of expatriates can result in a significant financial loss to the organisation. The company may also suffer from business interruptions, lack of business prospects, damage to the firm's reputation and leadership crises, which represent the immaterial costs of expatriate failure [17]. Other associated problems experienced by the individual assignee include low self-esteem, marital conflict, children who are displaced, lost income, diminished commitment to the parent company and tainted career reputation [18, 19]. In addition, expatriate failure may threaten the growth and expansion of foreign subsidiaries at the organisational level leading to lost opportunities in capturing new markets [20].

Toh and DeNisi [21] pointed out that organisational members, particularly, co-workers, supervisors and subordinates are reservoirs of valuable organisational information that newcomers need in order to become effective in performing their assigned roles. This is because host country nationals (HCNs) are most likely to possess relevant knowledge as well as having the necessary link to vital information that could benefit expatriate co-workers. Social perception is the process of interpreting information about another person, a way of forming impressions about oneself, other people and daily experiences [22]. Perception is culturally determined. Thus, based on one's cultural background, the individual turn to perceive things in certain ways. Therefore, it is essential to investigate how HCNs perceive expatriates, and whether such perceptions are influenced by the extent to which they are willing to interact with and provide support to expatriates. This study argues that perceptions of HCNs could influence their predisposition to exhibit helping behaviours that could be important for expatriates' adjustment. This study takes the view that the position occupied by HCNs relative to expatriates could impact on the provision of social support.

This study is guided by three main objectives: (1) explore how expatriates are perceived by host country nationals in Ghanaian host subsidiaries of multinational firms, (2) examine the effects of HCNs perceptions on social support provided to expatriates, and (3) investigate the extent to which HCNs position in the organisational hierarchy influence their readiness to support expatriates. The rest of the study is organised as follows. The next section provides literature review of previous research on expatriate assignment and host country national support, followed by a section on methodology. The findings are then presented and discussed. The study ends with practical implications and a conclusion.

2 Expatriate Assignment, Perceptions of Host Country Nationals and Social Support

The internationalisation of businesses and rapid technological progress demand increasing global mobility and flexibility in the workforce and work setting [23]. It has been recognised that increasing number of skilled workers search for international career opportunities, including expatriates [24] as there is a growing demand for culturally diverse and flexible employees with wide-ranging skill sets.

International business researchers suggest that human resource managers in the global arena must develop a global mind-set to enable them to effectively recruit and select the most qualified job candidates (either local employees or expatriates) for vacant positions, as well as retain them, in the various subsidiaries so as to achieve the strategic objectives of MNCs [25]. Ball et al. [26] also add that management of a company's workforce is a shared responsibility, in that the human resource manager must work hand-in-hand with executives from different departments in order to formulate suitable policies and procedures for the following purposes: estimation of human resource needs; recruitment and selection; training and development; motivation; compensation; discipline and employment termination. Ball et al. comment further that finding the right people to manage an organisation can be difficult under any circumstances, but it is especially difficult to find good managers of overseas operations. The right person needs to be bicultural, with knowledge of business practices in the home country as well as an understanding of business practices and customs in the host country. As acknowledged by human resource management scholars, the effectiveness of every organisation depends to a great extent on the nature of the workforce and the efficacy with which the organisation makes use of its human resources [26–28].

For a firm to outperform its competitors in the international arena, it must have the right people in the right postings [29]. These individuals must be well equipped and supported to perform their assigned tasks effectively while behaving in a manner that is consistent with the desired culture of the firm as well as the host country. Whether expatriates succeed or not on international assignment depends to a large extent on their cross-cultural adjustment to the host country [5, 8, 30]. The term cross-cultural adjustment refers to the key process of change an individual undergoes in adjusting to different environments [31]. It is a psychological outcome connected with an individual's adaptation to a new environment. The ability to adjust to differences in cultures and specific host-country values and norms plays a significant role in successful expatriation. The adjustment process demands that the expatriates spend some time identifying inappropriate behaviour that should be eschewed and also learn appropriate behaviours within the host culture.

In contrast, previous scholars suggest that the inability of expatriates to adjust to the various aspects of the host environment and function effectively can be attributed to socio-cultural factors [32, 33]. The expatriate is under an obligation to acquire the salient characteristics of the host culture as well as the basic knowledge including social skills from multiple sources such as the expatriate's supervisors, co-workers and subordinates so as to carry out his/her assignment successfully [34–36]. Also, HCNs in particular, can be very useful in assisting the expatriates to adjust and become effective in performing their assigned roles as they possess accurate knowledge of the host

culture and the company. This study draws on the relative deprivation theory (RDT) to suggest that HCNs perceptions of expatriates could result in cognitive, psychological and behavioural consequences [37]. The RDT presumes that individuals can be dissatisfied if they notice an unfavourable discrepancy between “value expectations” and “value capabilities” [38]. Sometimes, individuals might want more than they have and have less than they feel rightfully entitled to resulting in feelings of relative deprivation such as anger, grievance, moral outrage or resentment [39]. Consequently, how expatriates are perceived by HCNs will have a significant effect on expatriates' adjustment as support extended to expatriates can facilitate successful expatriation. For example, HCNs' opinions of expatriates will considerably shape the way expatriates are treated [40]. Such perceptions could either enhance or hinder how easily expatriates are supported by local employees to adapt to the host culture and the work environment. Oltra, Bonache and Brewster [41] contend that HCNs views of pay differentials, working conditions, norms and values, ethnocentric attitudes compared to expatriates could impact on working relationships. In a similar vein, this study suggests that the positions of HCNs compared to expatriates could influence HCNs preparedness to support expatriates. Thus, the following hypotheses:

- Hypothesis 1:* Host country nationals' perceptions of expatriates has a significant positive effect on social support.
- Hypothesis 2:* Positions of HCNs relative to expatriates effectively moderate the relationship between perceptions and social support.
- Hypothesis 3:* Host country nationals' evaluation of how well expatriates adjust in host cultures has a significant positive effect on social support.

3 Perceptions of Host Country Nationals and Expatriate Privileges

In the context of international assignment, HCNs and expatriates may be distinguished based on pay and status in the host subsidiary. Employees are compensated based on organisational roles, pay policies and organisational workgroup [42]. Even though expatriates are rewarded based on one or a combination of different approaches to expatriate compensation, the balance sheet approach remains the most widely used approaches. The key objective of this approach is to keep the expatriate whole (i.e., maintaining relativity with parent country colleagues). The balance sheet approach is designed to equalise the purchasing power of employees at comparable position living overseas and in the home country and to provide incentives to offset qualitative differences between assignment locations [43]. Accordingly, expatriates typically enjoy a rewarding experience with an advantageous compensation package and high social status within the host country [44]. Harvey [45] reports that headquarters expatriates consistently receive relatively preferential treatment such that pay discrepancies between HCNs and expatriates becomes problematic. HCNs may become resentful and hostile if they perceive expatriates are paid far more for similar responsibilities in host subsidiaries [46]. Thus, HCNs are likely to experience injustice when they observe that they receive less remuneration than their expatriate counterparts for performing similar

jobs [46]. As it has been argued resentment may lead to specific behavioural responses including anger, stress, violence and self-improvement [47]. Overall then, it is safe to propose that HCNs perceptions of expatriate privileges could influence support extended to expatriates. Thus, the following hypothesis:

Hypothesis 4: Host country nationals' perceptions of expatriate privileges is significantly and positively associated with social support.

4 Knowledge Transfer, Openness and Professionalism

A successful international assignment requires effective transfer of knowledge from the expatriate to local employees as well as assisting the host employees' gain better understanding of the organisation's goals, expectations and overall strategy. In general, international assignees engage in direct knowledge transfer by sharing parent company's cultural values and best management practices with their host subsidiary colleagues [48]. The strategic importance of international assignments has been described in terms of transferring business and technological know-how, developing personnel, facilitating and improving communications between subsidiary and headquarters and introducing a unified organisational policy and strategy [49, 50]. Indeed, some scholars contend that a MNC owes its survival to its superior ability to internally transfer knowledge, more effectively and efficiently than through market mechanisms [51].

Similarly, Bossard and Peterson [52] and Harzing and Van Ruyseveldt [53] emphasise that expatriates play a strategic role in ensuring efficient control and management of global operations, promoting knowledge transfer between headquarters and subsidiaries, and developing international experience for individuals and international thinking within the organisation. Following the work of Toh et al. [54] it has been argued that it does not matter how long an expatriate remain in the host country on the job, the assignment can only be viewed as successful if there exist some evidence of transfer of knowledge from the expatriate to the host country employees. This is what Wynne describes as the development of local management leadership, which is crucial for an organisation's long-term success [55]. It is therefore, vital for expatriates to act professionally in dealing with HCNs. They should be open to different opinions and receptive to different views and suggestions originating from HCNs. As HCNs' perceptions regarding knowledge transfer and how expatriates act in a professional manner in performing their assigned roles could have implications for support they are likely to receive from HCNs. Thus, this study hypothesises that knowledge transfer, and professionalism are important predictors of social support.

Hypothesis 5: Host country nationals' perceptions of knowledge transfer is significantly and positively related to social support.

Hypothesis 6: Host country nationals' perceptions of expatriates' openness is significantly and positively related to social support.

Hypothesis 7: Host country nationals' perceptions regarding professionalism is significantly and positively related to social support.

5 Methodology

This study uses the mixed methods research design as an appropriate method for addressing the research problem. It combines both qualitative and quantitative data in a single study as the study searches for multiple approaches to collecting and analysing data rather than relying on a single approach. The study sampled Ghanaian HCNs who are currently working with expatriates in host subsidiaries. These HCNs work with expatriates in Ghanaian MNCs across different sectors. A cover letter including the questionnaire were sent to respondents in their respective organisations by the researcher through a contact person. It was unequivocally stated on the cover letter of the survey that the study was solely for research purposes and as such responses from each participant would be kept strictly confidential. A total of six interviewed responses and 211 usable questionnaires were received for analysis.

Quantitative data was analysed using Smart PLS to test the proposed model. SEM is a family of statistical models that takes a confirmatory approach to multivariate analysis of a structural theory to explain causal relations among multiple variables [56]. SEM was considered for this study because researchers acknowledged that it is a better statistical technique compared to other multivariate techniques including factor analysis, multiple regression, and path analysis. It can also expand the explanatory ability and statistical efficiency for model testing with a single comprehensive method [57]. Content analysis was used to present data collected using interviews.

6 Results

The analysis of data revealed that overwhelming majority of respondents (93.8%) were below the age of 41, 22.7% of them had previous work experience with expatriates. More than half (64.9%) of the respondents occupied lower positions in the organisation, compared to the positions held by expatriate co-workers. Approximately 23% of the study participants are reported to have previous work experience with expatriates. Majority of respondents (83.4%) had up to five years working relationship with expatriates while 16.6% of them had worked with expatriates for more than five years.

The data was analyzed using the partial least squares - structural equation modelling approach with SmartPLS v.3 software [58]. The constructs modelled as reflective constructs, necessitating convergent validity and reliability tests. The results for reliability tests shown in Table 1 below indicate that CR values (between 0.818 and 1.00) and Cronbach's Alpha values (between 0.656 and 1.00) are well above the recommended threshold of 0.70 [59]. This implies that the measures used in the instrument are reliable and would produce consistent results if replicated on another sample. The AVE values fall between 0.500 and 1.000, thus showing acceptable convergent validity of measures (see Table 2). Results in Table 2 below show acceptable discriminant validity, where the diagonal values are greater than the off-diagonal values (the pair-wise correlation between factors).

Table 1. Validity and reliability of instrument/variables

Construct	Composite reliability	Cronbach's Alpha	Average variance extracted
Adjustment	0.838	0.700	0.726
Expatriate privileges	0.872	0.709	0.774
Knowledge transfer	0.889	0.843	0.616
Openness	0.882	0.800	0.715
Professionalism	0.885	0.837	0.611
Social support	0.851	0.741	0.656

Table 2. Discriminant validity

Construct	1	2	3	4	5	6
1. Adjustment	0.852					
2. Expatriate privileges	0.201	0.880				
3. Knowledge transfer	-0.146	-0.206	0.785			
4. Openness	-0.197	-0.228	0.628	0.846		
5. Professionalism	-0.038	-0.253	0.573	0.731	0.781	
6. Social support	-0.138	-0.400	0.402	0.553	0.541	0.810

Figure 1 below shows results from analyzing the proposed research model, indicating path coefficients (β) and explanatory powers (R^2) with results of the bootstrap method in SmartPLS to determine the significance of the relationships established in the research model. Overall, three hypothesized paths were found to be statistically significant. The results showed that HCN perceptions ($\beta = 0.599$; p value = 0.000; $p < 0.001^*$) had a positive and significant impact on social support, thus supporting H1.

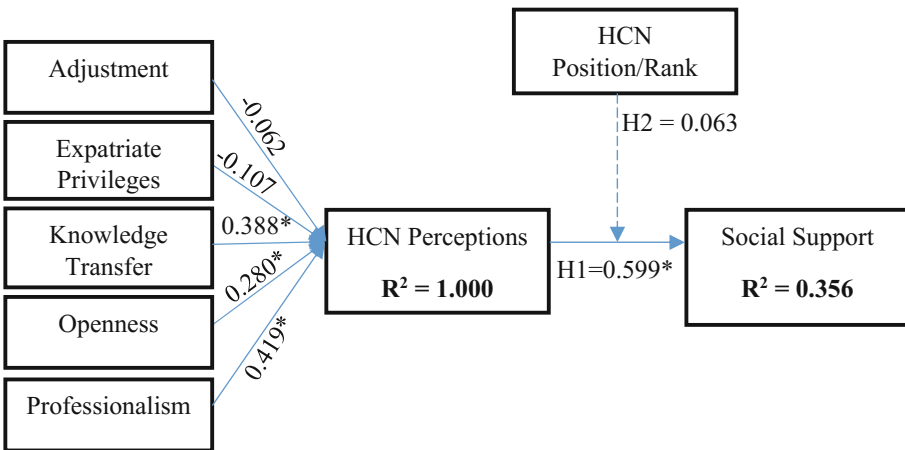


Fig. 1. Main model results

Further, in H2, employee position ($\beta = 0.063$; p value = 0.493; n.s.) was found to positively moderate the relationship between HCN perception and social support, but not significantly. In other words, when employees have a higher position than expatriates, the HCN perceptions results in greater social support (i.e. $\beta_{\text{HCN perceptions to social support}} + \beta_{\text{HCN position moderating effect}} \rightarrow 0.599 + 0.063 = 0.662$) and vice versa when employees have lower position than expatriate workers (i.e. $\beta_{\text{HCN perceptions to social support}} - \beta_{\text{HCN position moderating effect}} \rightarrow 0.599 - 0.063 = 0.536$). The resultant relationship between HCN perceptions is stronger in employees with higher positions ($\beta = 0.662$, n. s.) than in employees with lower position ($\beta = 0.5363$, n.s.). Knowledge transfer ($\beta = 0.388$, $p \leq 0.001^*$), openness ($\beta = 0.280$, $p \leq 0.001^*$) and professionalism ($\beta = 0.419$, $p \leq 0.001^*$) were found to be significant components of HCN perceptions.

Figure 2 below depicts results of direct effects of HCN dimensions of social support. In H3, contrary to a hypothesized positive relationship between adjustment and social support, results showed that adjustment ($\beta = -0.015$; p value = 0.900; n.s.) has statistically non-significant negative impact on social support. Hence, H1 was not supported. Similarly, expatriate privileges ($\beta = -0.263$; p value = 0.002; $p \leq 0.01^{**}$) exhibited a negative but significant impact on social support, hence, H4 was partially supported. H5 and H7 were also not supported because although knowledge transfer ($\beta = 0.016$; p value = 0.884; n.s.) and professionalism ($\beta = 0.245$; p value = 0.079; n. s.) were positive predictors of social support, their impact was not significant. In H7, Openness ($\beta = 0.300$; p value = 0.027; $p \leq 0.05^{***}$) was a significant predictor of social support. Overall, the dimensions explain about 35.6% of the variance for social support.

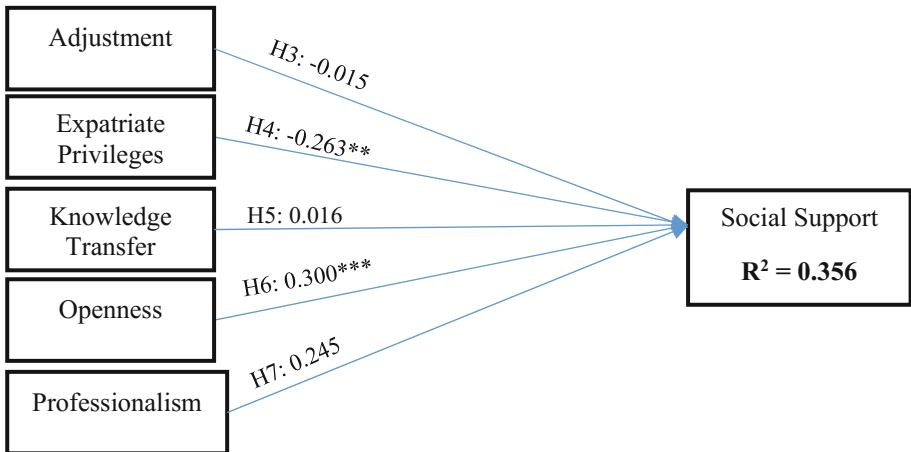


Fig. 2. Direct effect results

7 Discussion

The aim of this study was to explore how HCNs perceive expatriates and examine the effects of such perceptions on social support in host subsidiaries of multinational companies. Particular interest was with examining the relationship between HCNs position and social support. The results of the study indicate that HCNs perceptions significantly positively contributed to social support. While HCNs perceptions of openness significantly positively contributed to social support, perceptions of expatriate privileges negatively affected HCNs intention to provide social support. Results also suggest that HCNs' position relative to expatriates may either strengthen or weaken HCNs perceptions-social support relationships. Specifically, higher positions strengthen the relationship while lower positions weaken the relationship. Responding to the question what kinds of support is available to expatriates, respondents reported that:

R1: We also have one we call social support where you assist them. Sometimes when they come you have some people to go around with them to settle, housing and all that... we have somewhere to accommodate them so they don't have to move round looking for housing so when we have our houses ready when they come we just lodge them in and it is a fully furnished place.

R4:when they come to Ghana, we also have our cultural orientation programme for these guys so even before they will come to the office to work.

The findings of this study have implications for both researchers and multinational companies operating in different cultures across the globe. The results of the study suggest that how HCNs perceive their expatriate counterparts in terms of expatriate privileges and openness is significantly associated with social support. In general, this finding supports existing evidence for the relationship between HCNs perceptions and social support in foreign subsidiaries [54]. The findings of this study add to the theory of relative deprivation which postulates that people are likely to protest or rebel against their conditions not only when they are completely deprived but also when they "feel" deprived relative to some comparison others.

Not surprisingly, knowledge transfer and professionalism have no significant effect on social support. As suggested by McGuinness et al. [60], a major challenge for the MNC in the 21st century is to respond, proactively, to the difficulties associated with effective knowledge transfer within the context of an ever-changing global economy. The multiple dimensional and multiple directional nature of knowledge transfer may require a couple of individual exchanges, especially in the case of tacit knowledge [61, 62]. Clearly then, there is consensus that knowledge transfer is complex and very challenging across firms, within regional clusters and across strategic alliances [62].

8 Conclusion

This study's objective was to investigate the impact of HCNs' perceptions of expatriate on social support in Ghanaian multinational companies. It also examined the moderating effect of HCNs position relative to expatriates on provision of social support. The findings indicate that HCNs' HCN perceptions had a positive and significant impact on social support. Furthermore, the results revealed that position held by HCNs was found

to positively moderate the relationship between HCNs' perception and social support, but not significantly. Although knowledge transfer and professionalism were positive predictors of social support, their impact was not significant.

References

1. Earley, P.C., Peterson, R.S.: The elusive cultural chameleon: cultural intelligence as a new approach to intercultural training for the global manager. *Acad. Manag. Learn. Educ.* **3**(1), 100–115 (2004)
2. Eisenberg, J., Lee, H.-J., Brück, F., Brenner, B., Claes, M.-T., Mironski, J., Bell, R.: Can business schools make students culturally competent? Effects of cross-cultural management courses on cultural intelligence. *Acad. Manag. Learn. Educ.* **12**(4), 603–621 (2013)
3. Kim, Y.J., Van Dyne, L.: Cultural intelligence and international leadership potential: the importance of contact for members of the majority. *Appl. Psychol.* **61**(2), 272–294 (2012)
4. Firth, B.M., Chen, G., Kirkman, B.L., Kim, K.: Newcomers abroad: expatriate adaptation during early phases of international assignments. *Acad. Manag. J.* **57**(1), 280–300 (2014)
5. Caligiuri, P.: Assessing expatriate success: beyond just being there. In: Saunders, D., Aycan, Z. (eds.) *New Approaches to Employee Management*, pp. 117–140. JAI Press, Greenwich (1997)
6. Hechanova, R., Beehr, T.A., Christiansen, N.D.: Antecedents and consequences of employees' adjustment to overseas assignment: a meta-analytic review. *Appl. Psychol.* **52**(2), 213–236 (2003)
7. Koveshnikov, A., Wechtler, H., Dejoux, C.: Cross-cultural adjustment of expatriates: the role of emotional intelligence and gender. *J. World Bus.* **49**(3), 362–371 (2014)
8. Tung, R.: *The New Expatriates: Managing Human Resources Abroad*. Ballinger Publishing, Cambridge (1988)
9. Huff, K.C., Song, P., Gresch, E.B.: Cultural intelligence, personality, and cross-cultural adjustment: a study of expatriates in Japan. *Int. J. Intercult. Relat.* **38**, 151–157 (2014)
10. Peltokorpi, V., Froese, F.: Expatriate personality and cultural fit: the moderating role of host country context on job satisfaction. *Int. Bus. Rev.* **23**(1), 293–302 (2014)
11. Peltokorpi, V., Froese, F.J.: The impact of expatriate personality traits on cross-cultural adjustment: a study with expatriates in Japan. *Int. Bus. Rev.* **21**(4), 734–746 (2012)
12. Schiefer, D., Möllering, A., Daniel, E.: Cultural value fit of immigrant and minority adolescents: the role of acculturation orientations. *Int. J. Intercult. Relat.* **36**(4), 486–497 (2012)
13. Cole, N., Nesbeth, K.: Why do international assignments fail? Expatriate families speak. *Int. Stud. Manag. Organ.* **44**(3), 66–79 (2014)
14. Takeuchi, R.: A critical review of expatriate adjustment research through a multiple stakeholder view: progress, emerging trends, and prospects. *J. Manag.* **36**(4), 1040–1064 (2010)
15. Brewster, C., Bonache, J., Cerdin, J.-L., Suutari, V.: Exploring expatriate outcomes. *Int. J. Hum. Resour. Manag.* **25**(14), 1921–1937 (2014)
16. Kraimer, M.L., Shaffer, M.A., Harrison, D.A., Ren, H.: No place like home? An identity strain perspective on repatriate turnover. *Acad. Manag. J.* **55**(2), 399–420 (2012)
17. Minter, R.L.: Preparation of expatriates for global assignments: revisited. *J. Divers. Manag. (JDM)* **3**(2), 37–42 (2011)
18. Mendenhall, M., Oddou, G.: The dimensions of expatriate acculturation: a review. *Acad. Manag. Rev.* **10**(1), 39–47 (1985)

19. Naumann, E.: A conceptual model of expatriate turnover. *J. Int. Bus. Stud.* **23**(3), 499–531 (1992)
20. Puck, J.F., Kittler, M.G., Wright, C.: Does it really work? Re-assessing the impact of pre-departure cross-cultural training on expatriate adjustment. *Int. J. Hum. Resour. Manag.* **19**(12), 2182–2197 (2008)
21. Toh, S.M., DeNisi, A.S.: Host country nationals as socialising agents: a social identity approach. *J. Organ. Behav.* **28**(3), 281–301 (2007)
22. Wood, J., Zeffane, R., Fromholt, M., Wiesner, R., Morrison, R., Seet, P.-S., Schermerhorn, J., Hunt, J., Osborn, R.: *Organisational Behaviour: Core Concepts and Applications*. Wiley, Australia (2013)
23. Miles, I.: Knowledge intensive business services: prospects and policies. *Foresight* **7**(6), 39–63 (2005)
24. Al Ariss, A., Özbilgin, M.: Understanding self-initiated expatriates: career experiences of Lebanese self-initiated expatriates in France. *Thunderbird Int. Bus. Rev.* **52**(4), 275–285 (2010)
25. Briscoe, D., Schuler, R., Claus, L.: *International Human Resource Management: Policies and Practices for Multinational Enterprises*. Routledge, New York (2009)
26. Ball, D., Geringer, J., McNett, J., Minor, M.: *International Business: The Challenges of Global Competition*. McGraw-Hill/Irwin, New York (2013)
27. Schuler, R.S., Dowling, P.J., De Cieri, H.: An integrative framework of strategic international human resource management. *J. Manag.* **19**(2), 419–459 (1993)
28. Tayeb, M.: *International Human Resource Management: A Multinational Company Perspective*. Oxford University Press, Oxford (2005)
29. Hill, C.: *International Business: Competing in the Global Marketplace*. McGraw-Hill/Irwin, New York (2013)
30. Mezias, J.M., Scandura, T.A.: A needs-driven approach to expatriate adjustment and career development: a multiple mentoring perspective. *J. Int. Bus. Stud.* **36**(5), 519–538 (2005)
31. Caligiuri, P.M.: The big five personality characteristics as predictors of expatriate's desire to terminate the assignment and supervisor-rated performance. *Pers. Psychol.* **53**(1), 67–88 (2000)
32. Malek, M.A., Budhwar, P.: Cultural intelligence as a predictor of expatriate adjustment and performance in Malaysia. *J. World Bus.* **48**(2), 222–231 (2013)
33. Pomeroy, A.: Better executive onboarding processes needed. *HR Mag.* **51**(8), 16 (2006)
34. Furnham, A., Bochner, S.: Social difficulty in a foreign culture: an empirical analysis of culture shock. In: Bochner, S. (ed.) *Cultures in Contact: Studies in Cross-Cultural Interaction*, Vol. 1, pp. 161–198. Pergamon Press, Elmsford (1982)
35. Osland, J.: *The Adventure of Working Abroad: Hero Tales from the Global Frontier*. Jossey-Bass Publishers (1995)
36. Peterson, M.F., Rodriguez, C.L., Smith, P.B.: Agency theory and event management. In: Earley, P.C., Singh, H. (eds.) *Innovations in International Cross-Cultural Management*, pp. 131–182. Sage Press, Thousand Oaks (2000)
37. Runciman, W.G.: *Relative Deprivation and Social Justice. A Study of Attitudes to Social Inequality in Twentieth Century*. Berkeley University of California Press, UK (1966)
38. Ted, G.: *Why Men Rebel*. Princeton, Princeton University Press (1970)
39. Amelie, M., Kessler, T., Klink, A., Mielke, R.: Strategies to cope with negative socialidentity. Predictions by social identity theory and relative deprivation theory. *J. Pers. Soc. Psychol.* **76**(2), 229–245 (1999)
40. Arman, G., Aycan, Z.: Host country nationals' attitudes toward expatriates: development of a measure. *Int. J. Hum. Resour. Manag.* **24**(15), 2927–2947 (2013)

41. Oltra, V., Bonache, J., Brewster, C.: A new framework for understanding inequalities between expatriates and host country nationals. *J. Bus. Ethics* **115**(2), 291–310 (2013)
42. Ashforth, B.E., Johnson, S.A.: Which hat to wear. The relative salience of multiple identities in organisational contexts. In: Hogg, M.A., Terry, D.J. (eds.) *Social Identity Processes in Organizational Contexts*, pp. 32–48. Psychology Press, Philadelphia (2001)
43. Dowling, P.J., Festing, M., Engle Sr., A.D.: *International Human Resource Management*. Cengage Learning, UK (2013)
44. Bonache, J.: The compensation of expatriates: a review and a future research agenda. In: Stahl, G., Björkman, I. (eds.) *Handbook of Research in International Human Resource Management*, pp. 158–175. Edward Elgar Publishing, Cheltenham (2006)
45. Harvey, M.: Empirical evidence of recurring international compensation problems. *Res. Pract. Hum. Resour. Manag.* **9**(2), 27–56 (1993)
46. Toh, S.M., Denisi, A.S.: Host country national reactions to expatriate pay policies: a model and implications. *Acad. Manag. Rev.* **28**(4), 606–621 (2003)
47. Mark, M.M., Folger, R.: Responses to relative deprivation: a conceptual framework. *Rev. Pers. Soc. Psychol.* **5**, 192–218 (1984)
48. Chang, Y.-Y., Gong, Y., Peng, M.: Expatriate knowledge transfer, subsidiary absorptive capacity and subsidiary performance. *Acad. Manag. J.* **55**(4), 927–948 (2012)
49. Goerzen, A., Beamish, P.W.: The Penrose effect: “excess” expatriates in multinational enterprises. *Manag. Int. Rev.* **47**(2), 221–239 (2007)
50. Mir, R., Mir, A.: From the colony to the corporation: studying knowledge transfer across international boundaries. *Group Organ. Manag.* **34**(1), 90–113 (2009)
51. Foss, N., Pedersen, T.: Transferring knowledge in MNCs: the role of sources of subsidiary knowledge and organisational context. *J. Int. Manag.* **8**(1), 49–67 (2002)
52. Bossard, A., Peterson, R.: The repatriate experience as seen by American expatriates. *J. World Bus.* **40**(1), 9–28 (2005)
53. Harzing, A., Van Ruysseveldt, J.: *International Human Resource Management*, 2nd edn. Sage, London (2004)
54. Toh, S., DeNisi, A., Leonardelli, G.: The perspective of host country nationals in socialising expatriates: the importance of foreign-local relations. In: *Oxford Handbook of Socialisation*, pp. 230–249. Oxford University Press, New York (2012)
55. Wynne, B.: Public engagement as a means of restoring public trust in science—hitting the notes, but missing the music? *Public Health Genomics* **9**(3), 211–220 (2006)
56. Hair, J., William, C., Barry, J., Rolph, E.: *Multivariate Data Analysis*, 7th edn. Prentice Hall, Englewood Cliffs (2007)
57. Chin, W.: Issues and opinion on structural equation modelling. *MIS Q.* **22**(1), 7–16 (1998)
58. McGuinness, M., Demirbag, M., Bandara, S.: Towards a multi-perspective model of reverse knowledge transfer in multinational enterprises: a case study of Coats plc. *Eur. Manag. J.* **31**(2), 179–195 (2013)
59. Nonaka, I., Byosiere, P., Borucki, C., Konno, N.: Organisational knowledge creation theory: a first comprehensive test. *Int. Bus. Rev.* **3**(4), 337–351 (1994)
60. Rabbiosi, L.: Subsidiary roles and reverse knowledge transfer: an investigation of the effects of coordination mechanisms. *J. Int. Manag.* **17**(2), 97–113 (2011)
61. Easterby-Smith, M., Golden-Biddle, K., Locke, K.: Working with pluralism determining quality in qualitative research. *Organ. Res. Methods* **11**(3), 419–429 (2008)
62. Tallman, S., Jenkins, M.H., Pinch, S.: Knowledge clusters and competitive advantage. *Acad. Manag. Rev.* **29**(2), 258–271 (2004)

Management and Leadership of Company and Organizational Cultures



Attracting Tertiary International Students to the EHEA: Does Continent of Origin Matter?

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Abstract. The rise of international students has generated significant attention around the world including in the EHEA which has set out to increase international student mobility. In this paper we analyze patterns in the mobility of international students using the temporal framework developed by Choudaha [1]. We also look at variation within the EHEA and, more importantly, variation in the sending countries. The aim of this paper is therefore to increase our understanding of patterns in International student Mobility by focusing on the region of origin of students. By analyzing data made available by the UNESCO institute of statistics we uncovered that there are indeed substantial differences when looking at both host and countries. The implications of these findings are discussed with regards to effectively attracting and retaining international students.

Keywords: International student mobility · EHEA · Internationalization of higher education

1 Introduction

International student mobility (ISM) has become a global force as the number of tertiary students who decide to study abroad continues to increase. In fact, in between 1999 and 2015 the total number of international students has increased from close to 2 million to more than 5 million [2]. However, the growth in international students has seen much variation in both host and sending countries and has attracted considerable attention by policy makers [3]. The most successful countries in attracting international students have traditionally been the United States, the United Kingdom, Australia, Germany, and France, but other countries are now also emerging as popular destinations [4]. However, taken as a whole the largest region is the European Higher Education Area (EHEA) which hosted more than 41% of all international students in 2015, compared to 19% in the United States [2]. Of course, there is substantial variation within the EHEA which is worth consideration. This paper therefore investigates trends in ISM within the EHEA by comparing it to the United States and seeing how flows of students from different sending regions have changed over time. It is important to mention beforehand that there was not enough data available for Germany to be included in the analysis, except for the years 2013–2015. A word of caution is therefore

advised when interpreting the findings about the EHEA as a whole because they lack the share of international students that go to Germany.

In an effort to ensure the comparability of quality in higher-education standard, the Bologna process was signed in 1999 signaling the creation of the EHEA [5]. By now a total of 48 countries have signed this agreement, including not only all of EU countries, but also countries not traditionally consider European such as Russia, Turkey, and Kazakhstan. Since the very beginning, key goals of the EHEA have been to increase internationalization and ensure competitiveness by offering attractive higher education systems [6]. This translates to national goals set by countries to increase their share of international students, though no EHEA-wide target has been set due to large inequalities within the EHEA (for example France, Germany, and the UK account for 60% of the international students in the EHEA) [6]. What is not clearly specified is goals regarding attracting students from various sending regions, although this could potentially make a large difference.

One of the key insights in recent years has been an increased emphasis on the heterogeneity of the international student population [7]. For example, it has been found that Chinese students are much more sensitive to the quality of education than North American and Western European students [8]. While investigating differences in driving forces between students from different nationalities is beyond the scope of this article, we will consider different sending regions separately in order to uncover whether there are important trends. It has been uncovered, for example, that the large countries are slowly losing their share of international students and that smaller hubs are emerging [4]. The aim of this paper is therefore to shed further light on patterns in ISM within the EHEA and especially concerning the backgrounds of students.

1.1 Three Waves of ISM

The data presented in this paper will be structured according to the framework developed by Choudaha [1]. In his paper he distinguished three waves of ISM; Each of these waves was characterized and shaped by major political and economic developments and is therefore a useful framework for interpreting patterns in ISM.

The first wave, 1999–2006, was characterized by the desire of universities to attract international research talent, and often offered financial aid to students expressing their desire to study abroad. At the same time, the events of 9/11 made the United States more restrictive, while the formation of the EHEA made Europe more attractive. During this period a shift started to emerge where international students increasingly favored destinations other than the United States.

The second wave, 2006–2013, was rooted in the economic recession which prompted many higher education institutions to recruiting international students because of the higher revenue generated. During this time there was a large middle-class in China that was able to send students abroad without having to request extra financial aid. The Saudi-Arabian government also increasingly provided scholarships to send its citizens abroad. A consequence of this need to attract international students, however, was that many institutions lowered their entrance requirements such as English proficiency. In this time period, other source countries, such as Vietnam and Nigeria, were also emerging.

The third wave, starting in 2013, is characterized by a further decrease in the top 2 countries, the United States and the United Kingdom. This decrease is due to increasing anti-immigrant tones resulting from the election of Donald Trump in the United States, and Brexit in the United Kingdom. At the same time, there is a deceleration in the amount of students that China sends abroad because, on the hand, the Chinese government is focusing on improving its own education system, and the other hand, an increased reluctance of Chinese students in seeing the benefits of studying abroad. However, the gap created by Chinese students could well be filled by other emerging countries such as Vietnam, Nigeria, and India.

In this paper we intend to explore this framework more in-depth by looking at variation within the EHEA, and specifically how the patterns can be different based on the region of origin of the international students. This is especially salient because many previous studies have treated international students as though they are a singly coherent group while it is slowly being discovered that there exists large heterogeneity with ISM [7, 8]. In this paper we will look at the United States, the EHEA as a whole, and the 10 EHEA countries which had the largest share of international students in 2015. We also look at five host regions (Arab Countries, East Asia, Latin America, South and West Asia, and Sub-Saharan Africa) as defined by UNESCO [2]. We excluded North American and Europe because this would make comparisons between the US and the EHEA more difficult.

2 Methods and Data

All data used in this paper has been taken from the UNESCO Institute of Statistics. In the analyses 41 countries in the EHEA were included. Specifically, most countries that are currently a member of the EHEA are included in all waves even if they were not a member yet in the earlier waves. Some very small countries, such as Andorra and Liechtenstein, were excluded. More problematic however is that Germany could not be included in this analysis. The reason for this has to do with the way education is measured. UNESCO as well as many other institutions use the ISCED scale which was created to measure education in such a way that it becomes comparable between countries. Education in countries is then divided into several levels such as level 1 being primary education. Unfortunately, data for ISCED level 5B was missing prior to 2012 making estimates before these years non-comparable. As a result, UNESCO did not publish any figures about ISM in Germany before 2012 [9]. A result of this is that the statistics about the EHEA are severe underestimations because Germany was not included in these data.

In this analysis five of the region as defined by UNESCO were included: the Arab States, East Asia, Latin America, South and West Asia, and Sub-Saharan Africa. Central Asian students were not included because it is a relatively small share which is dominated by Russia, and there were too many missing data for Russia to make comparisons viable. North American and European students were also excluded from this analysis because, as was said earlier, it complicates comparisons. Specifically, if the aim is to compare how well the EHEA performs compared to the United States in attracting international students then it does not make sense to compare them based on

European or North American students. Comparing how many students from the EHEA are moving to the United States and vice versa would not contribute to the aims of this paper.

In the paper from which this research lends its framework [1] the author only selected the statistics for three years: 1999, 2006, and 2013 which corresponds to the border values of the three waves. However, this might lead to an incomplete picture since, for example, it excludes the tumultuous years following the recession of 2008. Furthermore, using only single years means it could be susceptible to outliers. Because of this, we decided to instead include all of the data that was available for the waves, instead of only the data for the border years. This not only gave us a more complete picture, it also meant that we could compensate more easily if a year had missing data (such as 1999).

Each of the number of the international students per wave were calculated by taking the average of the years in the waves of the share of international students. For example, the average share internationally mobile students coming to the United States in the years 1999–2006 is 9.86%. Most countries had sufficient data to be able to calculate these averages for each of the three waves, but there were some notable exceptions including Russia and Ukraine. In their case, there was no data available for wave 1 so they are excluded from the tables. All countries in the tables did have enough data to be able to include the year 2016. However, when calculating the average for the entire EHEA only enough data was available until 2015. The EHEA average was calculated by taking the sum of the share of international students of all countries in a certain year. Again, because Germany was excluded the figure does represent a severe underestimation. Data for Germany is available for the years 2013 until 2016 but we did not include this when calculating the value for the EHEA for wave 3. The reason for this is because it would lead to an invalid comparison between the number of international students in the EHEA between wave 3 and the two earlier waves. Nevertheless, to give an indication if Germany's share of international students: the average for wave 3 was 4.73%.

3 Results

Table 1 shows the global share of international students. It can be seen that the biggest countries, the USA, the UK, and France, all show a decline in wave 2 and 3 compared to wave 1. Especially France has seen a large decline in its share of international students. Interestingly, however, the global share of the entire EHEA was at its lowest point in Wave 1 indicating that there has been a growth in the share for the entire EHEA. It can be seen that the smaller countries, including Russia, Italy, the Netherlands, Turkey, and Ukraine, have all seen an increase over the years.

Table 2 shows the share of Arab international students and shows a completely different picture. The share of the United States has almost doubled in between wave 1 and wave 3. At the same time, the EHEA's share has declined dramatically. The smaller EHEA countries showed varying patterns. Some, like Turkey and Italy, showed an increase but many others showed a decrease in their share of international students. However, it appears that much of the EHEA's decline has been due to a decline of the share that France had. After seeing this result we investigated each Arab country more

Table 1. Global share of international students

Country	Wave 1 (1999–2006)	Wave 2 (2006–2013)	Wave 3 (2013–2016)
USA	21,85	18,69	18,83
EHEA ^a	35.76	37.30	35.92
UK	10,71	10,58	9,46
France	7,57	7,07	5,21
Russia	2,72	3,47	4,76
Italy	1,37	1,88	1,93
Netherlands	0,81	1,02	1,69
Turkey	0,69	0,78	1,29
Austria	1,33	1,59	1,48
Ukraine	0,74	1,01	1,19
Belgium	1,4	0,96	1,19
Switzerland	1,26	1,09	1,07

^aFigures for the total EHEA does not include Germany and thus should be considered carefully. The total share for wave 3 with Germany included is 40.65%.

Table 2. Global share of international students from Arab Countries

Country	Wave 1 (1999–2006)	Wave 2 (2006–2013)	Wave 3 (2013–2016)
USA	9,86	11,66	18,57
EHEA	46.43	43.11	32.52
UK	5,66	7,75	7,06
France	31,02	26,06	15,1
Russia ^a	–	1,54	0,88
Italy	0,84	1,42	1,32
Netherlands	0,84	0,12	0,13
Turkey	0,56	0,51	2,47
Austria	0,29	0,21	0,2
Ukraine	2,31	2,01	1,95
Belgium	1,88	0,18	0,4
Switzerland	0,55	0,5	0,44

^aData for Russia is missing for wave 1.

closely to see if there was one which stood out. The five biggest sending countries in the Arab States are in order Morocco, Saudi Arabia, Syria, Algeria, and Tunisia. The key in explaining this pattern might lie in Saudi Arabia: the share of international students coming to France from the aforementioned countries has been very large and relatively stable (Morocco around 60%, Syria around 10%, Algeria around 80%, and Tunisia around 50%). Saudi Arabia, on the other hand, sent fewer than 1% of its students to France in between 1999 and 2016. However, Saudi Arabia has also seen the largest total increase in outgoing students, far surpassing the other countries. E.g. the biggest country, Morocco, saw its outgoing students increase from almost 36,000 to

almost 48,000 in between 1999 and 2016. On the other hand, Saudi Arabia saw its outgoing students increase from more than 10,000 to more than 90,000 in the same time period. It appears that Saudi Arabian students favor English-speaking countries as the US, UK, Canada, and Australia hosted more than 85% of all Saudi Arabian students in 2016, with the United States have a lion's share of almost 65%.

When comparing (South-)East Asian students in Table 3 it can be seen that the patterns are remarkably more stable. The US has seen some decline and the EHEA has seen some increase in their share of (South-)East Asian students, but this is not as dramatic as with the Arab students. Again, within the EHEA there are diverging patterns. The UK, Italy, the Netherlands, Turkey, and Switzerland have seen an increase, and France, Russia, Austria, Ukraine, and Belgium have seen a decrease. It is especially remarkable that France's share of international students is much smaller when it comes to (South-)East Asian students then when looking at the total of international students. Of the (South-)East Asian countries, China is by far the largest, sending out 17% of the global international student population in 2017. This share has also increased between the waves with an average of 10.59% in wave 1, 15.21% in wave 2, and 17.08% in wave 3. Vietnam has also seen an increase in its share from 0.55% in wave 1 to 1.46% in wave 3. In contrast, Japan, South Korea, Indonesia, Thailand, Malaysia, and Singapore have all seen a decrease in their share of outgoing students. On a per country basis, the United States has seen an increase in its share of Chinese students (wave 1: 28.01%; wave 3: 34.13%). The same goes for the UK, Italy, the Netherlands, and Turkey. However, Austria, France, Russia, and Ukraine have all seen a decrease. A similar pattern is found for Vietnamese students which are moving more towards the US and less to other European countries. Especially France has seen a large decrease from 16.08% in wave 1 to 7.74% in wave 3. The opposite pattern is found for Japan, South Korea, Indonesia, and Malaysia are moving less to the United States and more towards European Countries such as the UK, France, the Netherlands, and Italy.

Table 3. Global share of international students from East Asian Countries

Country	Wave 1 (1999–2006)	Wave 2 (2006–2013)	Wave 3 (2013–2016)
USA	34,43	30,02	32,93
EHEA	15,75	17,54	18,04
UK	10,81	10,98	11,97
France	2,52	3,74	2,74
Russia	–	1,81	1,11
Italy	0,13	0,59	1,12
Netherlands	0,29	0,35	0,55
Turkey	0,04	0,08	0,23
Austria	0,23	0,23	0,11
Ukraine	0,82	0,62	0,21
Belgium	0,19	0,11	0,1
Switzerland	0,2	0,19	0,22

In Table 4, where students from Latin American Countries are shown, it can be observed that there has been a large decrease in the share that the USA has. The EHEA has been much more stable in this regard however, although it has also seen a decrease. Here, it can also be seen that the UK and France have a comparatively smaller share. Italy has seen a large increase, but the other countries have not changed much. Not shown in the table are Spain and Portugal which nonetheless have a relatively large share. Portugal had 1.39% in wave 1, 1.42% in wave 2, and 2.05% in wave 3; Spain had 6.3% in wave 1, 10.2% in wave 2, and 8.04% in wave 3, which means Spain has the biggest share of Latin American students in the EHEA.

Table 4. Global share of international students from Latin American Countries

Country	Wave 1 (1999–2006)	Wave 2 (2006–2013)	Wave 3 (2013–2016)
USA	40,91	27,74	24,9
EHEA	21.14	25	20.16
UK	4,65	3,59	3,39
France	5	5,74	5,08
Russia	–	0,4	0,26
Italy	1,34	2,47	2,74
Netherlands	0,63	0,33	0,62
Turkey	0,01	0,01	0,06
Austria	0,27	0,28	0,32
Ukraine	–	–	0,13
Belgium	0,42	0,2	0,36
Switzerland	0,78	0,81	0,73

Students from South and West Asian countries, shown in Table 5, have moved more to the USA and EHEA as well. Especially the difference between wave 1 and the other waves have been large. Within the EHEA, the UK is clearly the dominant country, though their share on international students has shifted a lot with the peak in wave 2. Similar to East Asian students, France has a comparatively smaller share. It can also be seen here that all of the smaller countries, with the exception of Russia, have seen an increase in their share of South and West Asian students. When looking at the data more closely, it can be seen that India is by far the largest sender of international students. Pakistan and Iran have also always sent out many students, but countries that have increased the most are Afghanistan, Bangladesh, and Nepal. The patterns for Indian, Pakistani, Bangladeshi, Afghani, and Nepalese students have been remarkably similar: The United States has seen a general decline in their share of students from these countries; the UK has witnessed an upsurge in between wave 1 and wave 2, and a down surge in between wave 2 and wave 3, with wave 3 being the lowest of the three waves. The Western European countries generally witnessed an increase, although their share did not become substantial. When it comes to Iran, the United States has seen an increase in their share, as have many other European countries with the exception of Ukraine and the United Kingdom.

Table 5. Global share of international students from South and West Asian Countries

Country	Wave 1 (1999–2006)	Wave 2 (2006–2013)	Wave 3 (2013–2016)
USA	16,53	21,43	21,14
EHEA	6.41	15.01	13.12
UK	4,25	8,75	5,31
France	0,48	0,74	0,68
Russia	–	1,02	0,72
Italy	0,18	0,61	1,05
Netherlands	0,1	0,11	0,32
Turkey	0,2	0,34	1,2
Austria	0,17	0,25	0,26
Ukraine	0,54	0,66	0,66
Belgium	0,07	0,11	0,12
Switzerland	0,1	0,16	0,17

Finally, Table 6 shows the share of students from Sub-Saharan African countries. In contrast to the previous results, the US has a much smaller share of students here; it is 3–4 times as small as the EHEA. It can also be seen that much of the EHEA's share belongs to France and much less to the UK. The other EHEA countries all have a much smaller though mostly increasing share.

Table 6. Global share of international students from Sub-Saharan African Countries

Country	Wave 1 (1999–2006)	Wave 2 (2006–2013)	Wave 3 (2013–2016)
USA	5,98	5,65	4,82
EHEA	14.59	18.52	16.76
UK	4,19	5,4	4,47
France	7,02	8,35	6,21
Russia	–	0,87	0,6
Italy	0,41	0,85	1,06
Netherlands	0,1	0,09	0,13
Turkey	0,06	0,14	0,78
Austria	0,08	0,09	0,07
Ukraine	–	–	1,02
Belgium	0,68	0,28	0,61
Switzerland	0,24	0,22	0,16

As was stated before, Germany was excluded from the tables because only data for wave 3 was available. Nevertheless, to make the picture complete we will report its share per region here as well. The global share that Germany had for wave 3 was 4.7%. When comparing it per region, only data for the years 2013, 2014, and 2015 was available. Germany's share was as follows: 2.89% of Arab Students, 2.68% of East Asian students, 3.84% of Latin American students, 2.41% of South-West Asian Students, and 1.47% of Sub-Saharan African Students.

4 Conclusion and Discussion

This paper examined patterns in the share of international students studying at the United States and at the EHEA in contrast to most previous papers which looked at the absolute numbers of students. The data was analyzed using the theoretical insights stemming from Choudaha [9] who divided up ISM into three waves. The results presented here show a complex picture and highlight the importance of taking into account the region of origin of students when analyzing macro-patterns. Overall, the share international students studying at the EHEA and United States has remained fairly stable. Within the EHEA however it can be seen that the larger countries (France and United Kingdom) have seen a decline while smaller countries have seen an increase. The United States has also seen a decline compared to wave 1. However, this pattern is not the same for each region of origin. The United States has witnessed a large growth in its share of Arab Students in contrast to large decline by France. This can largely be explained by the increase in students from Saudi Arabia. On the other side, it can be seen that the United States lost much of its share of Latin American students, but which are increasingly moving to smaller EHEA countries. Students from (South-)East Asia are still largely moving to traditional destinations (US and UK), but smaller EHEA countries have seen more varied results. Southern and Western Asian students are also going more towards the smaller EHEA countries, though the share by the US and UK remains substantial. Finally, students from Sub-Saharan Africa has shown a more stable pattern and interestingly it is the only region where the United States is not the biggest country.

In general, these findings are in line with previous literature. For example, the rise of smaller countries has been indicated as a development [4]. It has also been found by Shields that the EHEA is increasing in its student numbers, though he also reported that globally flows of international students have become more unequal and centralized [11]. The results are also similar to what Choudaha discussed in his paper about the three waves on which this is based [1]. In the paper, he stated that in wave 3 it is likely that international student flows to the US and UK will slow down which can also be observed in the findings here. However, differentiating by region illuminated new patterns such as the change in Arab students and the role that Saudi Arabia plays. France especially has witnessed a great variation in its incoming students which is an interesting avenue to explore further.

What is also important is trying to find common factors that can explain increases decreases in international students. At the moment clearly defined theoretical frameworks are still missing and support for existing theories is sparse [11, 12]. Language probably plays a large role with English-language countries having an advantage. However, the dominance of France in attracting Sub-Saharan students could also well be due to language since many Sub-Saharan countries have French as a second language. The effect colonial ties should also be considered: South and West Asian students are moving to the UK and Algerian students are moving towards France. Indeed, the effect of language and colonial ties has generally been found to be significant [12]. Other connection might also be very relevant, for example Shields [11] observed that migration patterns closely followed trade patterns.

There are some limitations to this paper. The omission of Germany is very regrettable because it means the figures about the EHEA presented here are lower than the real number. It is also unclear what Germany's influence is on the general increase or decrease of the EHEA. Comparable to this is that several countries, particularly Eastern European ones, had missing data. However, this problem was largely mitigated because we calculated the average of the waves. Nevertheless, the real figures could differ from the ones presented here. A second limitation has to do with the focus on nation-states as the unit of analysis. While it is important to compare differences between nation-states, it should not be forgotten that there are also large inequalities *within* nation-states that have yet to be properly explored [10]. This is also important for examining the relative influence that governments and HEIs have on attracting international students. It is important for future research to critically consider the heterogeneity that exists in these patterns of international student mobility. As Shields [11] rightfully points out, global student flows are immensely complex and identifying clear unambiguous trends is problematic.

If the EHEA has as its goal to attract more international students, it needs to consider how to manage the differences between the regions as these findings show that these differences are substantial. Different host countries can have different appeals including language, cost of living, and quality of education. At the same time the factors that attract students can be very different based on the sending region. For example, it has already been found that the quality of education is more important to East Asian students than to North American students [8]. This has implications for example for the decision to pursue accreditations and other recognitions. There is also the question of retaining students as increasing competition between HEIs means there also needs to be an increased emphasis on student success and meeting career expectations [1]. Our recommendation for any government or higher education institution is therefore to carefully monitor and analyze which students they are receiving and what the trends are over time. Clearly, the heterogeneity in incoming international students is too complex to create policies that can be applied uniformly. This means that in order to facilitate successful policies there also needs to be clear communication between governments and higher education institutions. It is unclear how much variation exists within countries, but it is becoming increasingly clear that one-size-fits all policies might not be efficient.

References

1. Choudaha, R.: Three waves of international student mobility (1999–2020). *Stud. High. Educ.* **42**(5), 825, 832 (2017)
2. UNESCO Institute for Statistics. <http://data.uis.unesco.org/Index.aspx>
3. Lam, Q.: National Policies on Mobility in Europe. *Int. High. Educ.* **67**, 13–14 (2012)
4. Kondakci, Y., Bedenlier, S., Zawacki-Richter, O.: Social network analysis of international student mobility: uncovering the rise of regional hubs. *High. Educ.* **75**(3), 517–535 (2018)
5. The Bologna Declaration of 19 June 1999: Joint declaration of the European Ministers of Education. https://www.eurashe.eu/library/bologna_1999_bologna-declaration-pdf/

6. Report of the 2012–2015 bfug working group on mobility and internationalization. http://www.ehea.info/media.ehea.info/file/2015_Yerevan/71/7/MI_WG_Report_613717.pdf
7. Kavakas, D.: Students as consumers: identifying study abroad destination choice influences for marketing purposes. American College of Thessaloniki (2013)
8. Choudaha, R., Orosz, K., Chang, L.: Not all international students are the same: understanding segments, mapping behavior. *World Educ. News Rev.* **25**, 7 (2012)
9. Ejov, D.: UNESCO Institute for Statistics, personal correspondence
10. Van Mol, C., Ekamper, P.: Destination cities of European exchange students. *Geogr. Tidsskr.-Dan. J. Geogr.* **116**(1), 85–91 (2016)
11. Shields, R.: Globalization and international student mobility: a network analysis. *Comp. Educ. Rev.* **57**(4), 609–636 (2013)
12. Findlay, A.M.: An assessment of supply and demand-side theorizations of international student mobility. *Int. Migr.* **42**, 2 (2010)



Econometric Modeling of the Efficiency in the Generation of Electric Power in Chile

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Abstract. This research proposes the estimation of stochastic frontiers model using panel data, to measure the technical efficiencies in 4 perspectives for the electricity generation sector in Chile for the period 2010–2015. The first perspective is to analyze the main companies in the sector; the second is about generation plants based on their contribution only as energy generates; the third is also power plants, but this time considering its contribution as generation and security to the system; and a fourth analysis is following the third model, but this time only considering the year 2015 in order to get a greater sampling of power plants and generation sources. The estimation also used 2 functional forms of production for each analysis: Cobb-Douglas and Translogarithmic that are compared to obtain the best representation of the data. The results show to which companies, plants and generation sources are the most and least efficient.

Keywords: Electric power · Econometric modeling ·
Technical efficiency - energy generation

1 Introduction

In the last decade, energy issue in Chile has had a great impact on the national debate, being among the topics most commented on by Chileans, overcoming traditional issues of national interest such as health, education or citizen security. The reason of this great media growth was the protest marches of discontent citizens against the project that pretend to be the country's largest power station: the HidroAysén project, led by the country's biggest energy companies: Colbún and Endesa. The dam would be located on the Baker River, in the Aysén region, and would require 3,200 km. of construction in transmission lines. After much debate, for a long period of time, the project was rejected and abandoned, but it was not the only project in sight. The disappointment also encompassed projects such as: Punta de Choros (IV Region), Hidroeléctrica Alto Maipo (RM, currently under construction) and transmission lines, currently protests in Olmué against the Polpaico-Cardones line that would connect the electric transmission systems from the north (SING) and the central and south (SIC), part of Chile. This

situation of disconformity with some big electrical generation projects are not only present in Chile but in several countries of the world. In general, people expect to move towards a more diversified energy matrix and to empower the contribution in the electrical generation of renewable non-conventional sources, to produce clean, renewable and sustainable energy.

In Chile, for example, the laws called Ley Corta I (2004), Ley Corta II (2005) and Pro Non-Conventional Energy (NCRE) Law (2007) aim to clarify transmission charges, to liberate of those charges small generators, to facilitate participation in bidding processes, to promote investment in the generation sector and to encourage the creation of non-conventional renewable energy (NCRE) projects with a goal of reaching a 20% contribution of NCRE throughout the matrix to the year 2020, which will be fulfilled by 2019. These regulations modified and facilitate investment in sustainable energies, after the supply crisis that occurred due to changes in the economic policy of our provider, which at that time precipitated the internal provision.

In 2011, during the first government of Sebastián Piñera, motivated by social protests to large generation projects, the Advisory Commission for Electrical Development (CADE) was created. Its main objective is to recommend a policy to develop energy growth base in clean, safe and economical sources to comply with the imminent growth of energy demand. Thus, the great conclusions of the panel of experts of this commission focused on taking advantage of the sources of water in the south of the country, generating progress for the eventual use of nuclear energy in the future and promoting the NCRE to make them more competitive.

These proposals deal with the situation of the Chilean generation system at that time, where in the north it is mainly supported by thermal energy sources, and in the south-central part by a mix of water and thermal sources. Therefore, according to the conclusions of the commission and facing the future and imminent union of the Interconnected System of the Great North (SING) and the Central Interconnected System (SIC), it can be inferred that the great nourishment for the energy matrix in Chile would be hydroelectric sources, both to large mining projects in the north, as well as to industrial and residential consumption.

However, there are some natural inquiries to this proposal. First, does it really respond to people's demand? Second, would it be possible to depend only on hydro-electrical power considering climate change and the floods that require their construction? Currently, there is no source of energy capable of satisfying all the demands of society, presenting all the positive characteristics that are sought in an energy matrix: clean, safe and cheap, and practically without generating negative externalities in its construction path. Hydroelectrical power is not completely secure because its supply depends on rainfall and requires the construction of reservoirs that flood big land portions. There are doubts about building nuclear power plants in a seismic country, as shows Japan experience, which is also prone to earthquakes. Consequently, there is a national consensus that the energy matrix of our economy must have mixed sources of generation. All sources of energy have their advantages and disadvantages, but it is the duty of those who plan the energy supply strategy to find the best combination of sources that guarantees energy consumption, economic growth, a clean and renewable environment, according to the available and feasible sources [1–4].

Therefore, the question is to find out the most efficient resource to generate electrical power. Thus, the present research, using stochastic production frontiers, assesses the efficiency in the production of electrical power according to the different technologies and sizes of the generation plants in Chile.

The purpose of this research is to determine and evaluate the technical efficiencies of the generation market in Chile, through two different considerations: the main generation plants and the main generation companies in Chile, both for the period of 2010–2015. This evaluation will build a ranking of the most efficient plants and companies and analyze the existence of common patterns in the different types of generation sources (thermal, hydroelectric, and renewable).

2 Methodology

Regardless of the type of organization (companies, organizations, countries, branches, plants, etc.) there is a basic principle of production that encompasses them all. To produce goods and services is necessary to use scarce resources: productive factors, which due to management can be combined in different and multiple ways to reach a production level. The choice of this combination of a better productive method aims to maximize the benefits given a certain proportion of productive factors or to a minimize production costs associated to a level of production [5, 6]. This maximum level of production is represented theoretically by the production possibilities frontiers (FPP) or production boundary functions.

In practice, productive economic agents are not always using their resources at the optimum level that would leads to its maximum benefit, hence, production may incorporate certain inefficiencies.

Economists usually use an enterprise production function to summarize information about the technically efficient production methods available to each company. The production function of a firm shows the maximum amount of output that can be obtained with a given number of factors and shows the results of different technically efficient production methods [7].

Productivity is a measure of efficiency; this can be expressed as the ratio between the amount of goods and services produced and the amount of resources used. On the other hand, efficiency is the relationship you have between effective production and the inputs required to achieve the minimum cost for that level of production. The mathematical expression of the production function is given by the following array:

$$\ln(y_{it}) = x_{it}\beta + v_{it} - u_{it} \quad (1)$$

The production frontier shows the maximum production level considering technology and the endowment of resources, implying that is the level of production that provides the highest level of utility or satisfaction that can be reached, given the resource constrains. The relationship between inputs and output shows the opportunity costs relevant for the economy [7–9].

As the production frontier is the limit of what is possible to produce given the factor endowment, any point situated beyond the boundary is unattainable while the ones

located inside the frontier represent inefficient situations characterized by idle resources.

The production frontier is modelled under two alternative production functions, the ones that usually are considered in the related literature [7], the Cobb-Douglas (Eq. 2) and the Translogarithmic (Eq. 3).

$$q = f(K, L) = AK^\alpha L^\beta \quad (2)$$

$$\ln q = \beta_0 + \sum_{i=1}^n \beta_i \ln X_i + 0,5 \sum_{i=1}^n \sum_{i=1}^n \beta_i \ln X_i \ln X_j \quad (3)$$

3 Results

We will work with a panel data structure, presented by quarter, given that the financial statements of large companies (SA) are presented quarterly, and will cover from 2010 to 2015. The analysis will be carried out in two instances: companies and power plants, whose results will allow to analyze the company's strategies and the mix of energy sources that they manage.

3.1 Analysis of Companies Behaviour

This analysis for the period 2010–2015 includes 4 companies that operate in the sector: AES Gener, Endesa, Colbún and E-CL. Although there may seem few companies to study the market, it is justified because the first three mentioned capture more than 75% of the market in the SIC, and the last almost 50% of participation in the SING, capturing more than 80% of the generation in both lines.

The production frontier is estimated using the Cobb-Douglas functional forms (Table 1) and the Translogarithmic (Table 2), and the results are as follows:

Table 1. Cobb-Douglas estimation companies

	Coefficient	Standard-error	t-ratio
beta 0	6.44	1.60	4.02
Costo Venta	-0.01	0.00	-13.50
Gasto ADM	0.58	0.12	4.99
Capacidad Neta	0.01	0.00	4.13
sigma-squared	0.08	0.07	1.25
Gamma	0.91	0.07	13.76
Mu	0.55	0.62	0.89
Eta	0.00	0.01	0.18

log likelihood function: 67.20

LR test of the one-sided error: 148.44

With number of restrictions: 3

Table 2. Translogarithmic estimation companies

	Coefficient	Standard-error	t-ratio
beta 0	13.70	1.13	12.17
Costo Venta (CV)	-0.01	0.00	-26.57
Gasto ADM (GA)	-0.51	0.10	-4.97
Capacidad Neta (cap)	-0.01	0.00	-5.02
0,5*CV*GA	-1.01	0.13	-7.87
0,5*CV*cap	-0.01	0.00	-6.81
0,5*GA*cap	0.68	0.07	9.31
CV ²	0.01	0.00	6.21
GA ²	0.17	0.02	8.30
Cap ²	0.00	0.00	4.10
sigma-squared	0.02	0.00	4.02
gamma	0.60	0.15	4.00
mu	0.21	0.10	2.15
eta	-0.02	0.01	-2.66

log likelihood function: 91.37

LR test of the one-sided error: 29.37

With number of restrictions: 3

In the first place, it is verified that both models, Cobb-Douglas and Translogarithmic, have the presence of technical inefficiency at 99% confidence interval given the values of their maximum likelihood ratios.

Another comparison is obtained by the gamma coefficients, where the closer to 1 indicates that the deviations obtained by companies are more linked to technical inefficiency, and by reviewing the gamma coefficients of both functional forms, it is observed that the Cobb-Douglas may be a better representation, since its gamma of 0.91 indicates that 91% of the deviations are due to technical inefficiencies versus the 0.60 gamma of the Translogarithmic function.

To know which representation is best suited to the data, a test must be performed calculating a generalized likelihood ratio (LR). To calculate the generalized likelihood ratio, the test uses the values of the logarithmic likelihood functions of both estimated functions, using as a null hypothesis the Cobb-Douglas functional form and as an alternative hypothesis to the functional form the Translogarithmic one. According to the test, if the value obtained LR is greater than the chi-square, taking as degrees of freedom the number of parameters of the second order of the null hypothesis at 95% confidence, then the null hypothesis is rejected. In this case the Cobb-Douglas model would be rejected, to accept the alternative hypothesis, the Translogarithmic function. Vice-versa in case it is less.

In the estimations made, a log-likelihood function value of likelihood was obtained for the Cobb-Douglas function of 148.44, and a value of 29.37 for the Translogarithmic function. Therefore, replacing the values according to the formula of the test results in an LR of:

$$LR = -2[(148.44) - (29.37)] = -238.14$$

This value is compared with the corresponding chi-square value of 9.4877, so that since LR is a smaller value, the null hypothesis that the Cobb-Douglas boundary is a better representation for the data is accepted.

The first conclusion reviewing this model is about the coefficient of the eta value, which turns out to be zero which indicates that there is no decrease or increase in technical efficiency in the analysis period for this sector according to these estimates.

Afterwards, the evolution of the technical efficiency in the time of the analysis by company is processed, ranking them according to its efficiency calculated by the average of the efficiencies of the companies along the time. The results shows that Endesa remains in the first place reaching an average efficiency of 85.07% and being the only one above the general average of the 4 companies; followed by Aes Gener with 48.98%, then in third place Colbún with an average efficiency of 43.99% and finally E-CL with 36.33%.

Regarding the efficiency over time as general averages, this rises by 0.75% in the 6 years considered by the study. This small increase can be considered as the technical efficiency in the sector practically remains unchanged over time.

3.2 Power Plants Analysis

This analysis is carried out for 92 plants present in this research for the period 2010–2015, which includes 24 quarters. Although there are many more centers operating in the SIC and SING lines, the Balanced Panel Data methodology requires monitoring of the data within the study period, and many plants, especially new NCRE plants, have started operations mostly in the years of 2014 and 2015, so they can not be incorporated into the study. This mean that solar plants were not included in the sample of power plants, which began their biggest operations since 2014.

The production frontier estimates using the Cobb-Douglas functional forms (Table 3) and the Translogarithmic (Table 4) are the following:

Table 3. Cobb-Douglas estimation power plants

	Coefficient	Standard-error	t-ratio
beta 0	6.72	0.83	8.12
Costo Marginal	-0.13	0.09	-1.46
Capacidad	1.13	0.07	16.04
sigma-squared	139.55	30.16	4.63
gamma	0.9551	0.01	94.75
mu	-23.09	4.16	-5.55
eta	-0.03	0.00	-13.35

log likelihood function: -5,304.06

LR test of the one-sided error: 1,570.56

With number of restrictions: 3

Table 4. Translogarithmic estimation power plants

	Coefficient	Standard-error	t-ratio
beta 0	5.10	5.52	0.92
Costo Marginal (Cmg)	0.72	0.48	1.50
Capacidad (Cap)	1.18	1.03	1.15
0,5*Cmg*CMg	-0.16	0.12	-1.34
CMg ²	-0.01	0.05	-0.21
Cap ²	0.01	0.05	0.25
sigma-squared	138.22	28.72	4.81
gamma	0.9550	0.01	90.29
mu	-22.98	6.50	-3.53
eta	-0.03	0.00	-11.79

log likelihood function: -5,302.47

LR test of the one-sided error: 1,234.75

With number of restrictions: 3

The likelihood ratio test is carried out, confirming that in both functional forms the presence of technical inefficiency at 99% confidence is found. Both models also showed gamma coefficients close to 1 (0.955) indicating that deviations between plants are strongly explained by technical inefficiency.

To define the model that best fits the data, the generalized likelihood ratio (LR) is calculated, although it should be mentioned that there were no large differences in the rankings by more efficient sources and plants.

The LR obtained a value of -671.61, which is less than the chi-square value corresponding to this model, which is a value of 7.81, and therefore in this case the null hypothesis that the Cobb frontier is accepted. Cobb-Douglas is a better representation for the data and consequently its results are accepted as conclusive.

The Cobb-Douglas model showed that there is a decrease in technical efficiency within the analysis period, where the average technical efficiency of the sample falls 12 points from 2010 to 2015. The presence of decrease is aligned with the trend indicated by the coefficient eta. This indicator has the same negative coefficient in the Translogarithmic function.

Regarding the power plants studied, there is no source that has 100% efficiency, or an approximate value. The preceding result is aligned with the reality and opinion of experts, since there are no sources with continuous supply and high plant factors, and at the same time with low operating costs.

According to the results, the most efficient generation means correspond to coal (with an average technical efficiency of 63%), followed by run-off-the-river hydroplant (59% of technical efficiency) and thirdly, biomass plants (46% technical efficiency). In the middle places are hydroelectric dams (41%), wind turbines (25%) and combined cycle power plants (23%). In the last places of the ranking are the petroleum power plants, which are hyper-inefficient regardless of their size, with results lower than 10% technical efficiency on average.

4 Conclusions

Technical efficiency is achieved when power plants maximize output using all the available inputs. Determining its level provides with a valuable insight into the behavior of the companies and power plants in the period under review and allows comparing the results each other. If power plants are not using their resources properly, they can make economic adjustments that permit them to increase production and improve efficiency [10].

Regarding the results and efficiency differences obtained by the companies, these may be related to the mix of energies they have implemented. Endesa, which has the highest efficiency and increases the average for the sector, is the most diversified in the technologies it uses to generate power. Of the four large companies, it has the most in installed hydro capacity (run-of-river and dams) and ERNC (solar, biomass and wind), both nominally and in proportion, with the latter having the lowest marginal cost. In addition, it is the one who least concentrates its activity in oil power plants, which are the most expensive to operate in the system. About thermal energies, Endesa centralizes its matrix in combined cycle plants, that is, in plants that can alternate their production between diesel or natural gas, seeking an advantage in gas that is cheaper.

Ensuing is Aes Gener, a company that concentrates its matrix in thermal coal and followed by combined cycle. Both sources have medium average costs, since coal and natural gas tend to conflict with hydroelectric resources over which are cheaper, although this is very volatile (it depends on hydrological and climatic activity). In addition, these sources usually have a high contribution in installed electrical power, which allows greater gains in power and have a high activity, allowing gains in power and energy.

In the third place, Colbún is positioned, even though is a company that also has a very diversified matrix, which after Endesa is the one with the most installed capacity in hydroelectric power. However, it is worth mentioning that it has the most installed capacity in purely diesel oil plants, both nominally and proportionately, being the most expensive type of energy, which could be pushing it to worse efficiency results compared to the previous two competitors.

Finally, the company E-CL is the least efficient. Its matrix is similar to Aes Gener in proportions, although more concentrate on thermal since it is concentrated in the SING so its geographical behavior matches with thermal dependence. Both companies concentrate their activity on coal followed by the combined cycle, and they have similar proportions of their capacity as diesel power plants (14% E-CL and 12% Aes Gener). Although their similarities in their matrices, the efficiencies results are different, so the compositions of E-CL matrix may not be the only cause that explain the efficiency differences, otherwise it would have obtained similar results to Aes Gener.

Regarding the results obtained from the analysis by power plants, the oil power plants have the worst results, despite that they represent the largest group in the sample. None of these plants occupied a position above the general average. Moreover, most of them are under 10% efficiency, and a considerable group of these plants have efficiencies on average less than 1. This could be explained given that oil plants are recognized as having higher marginal costs, so their greater contribution is to the

installed electrical power more than to the generation of energy [11]. These plants go through long periods of time with no production. Therefore, these kinds of plants have low technical efficiency results.

References

1. Kraft, J., Kraft, A.: On the relationship between energy and GNP. *J. Energy Dev.* **3**, 401–403 (1978)
2. Squalli, J.: Electricity consumption and economic growth: bounds and causality analyses of OPEC members. *Energy Econ.* **29**(6), 1192–1205 (2007)
3. Ozturk, I.: A literature survey on energy–growth nexus. *Energy Policy* **38**(1), 340–349 (2010)
4. Barreto, C., Campo, J.: Long-term relationship between energy consumption and GDP in Latin America: an empirical assessment using panel data. *Ecos de Economía* **16**(35), 73–89 (2012)
5. Aigner, A., Lovell, C.A.K., Schmidt, S.: Formulation and estimation of stochastic production function models. *J. Econom.* **16**, 21–37 (1997)
6. Coelli, T., Prasada, D.S., Battese, G.: *An Introduction to Efficiency and Productivity Analysis*. Kluwer Academic Publishers (1998)
7. Nicholson, W.: *Teoría Microeconómica: Principios básicos y aplicaciones*, Sexta edición, p. 599. Editorial McGraw-Hill (1997)
8. De la Fuente, H., Paz, A., Conover, R., Khan, A.: Forecasting of financial series for the Nevada department of transportation using deterministic and stochastic methodologies. *Proc. Manuf.* **3**, 3317–3324 (2015)
9. Sahagun, L., Karakouzian, M., Paz, A., De la Fuente, H.: An investigation of geography and climate induced distresses patterns on airfield pavements at U.S. Air Force installations. *Math. Probl. Eng.* **2017**(8721940), 1–10 (2017)
10. Altinay, G., Karagol, E.: Electricity consumption and economic growth: evidence from Turkey. *Energy Econ.* **27**, 849–856 (2005)
11. Merrill, S., Paz, A., Molano, V., Shrestha, P., Maheshwari, P., Stephen, H., De la Fuente, H.: The feasibility of a Land Ferry system to reduce highway maintenance cost and associated externalities. *Sci. World J.* **2016**(8180232), 10 (2016). <https://doi.org/10.1155/2016/8180232>



The Use of Ergonomic Methods for Ensuring the Competitiveness of Business Structures

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Abstract. Improving the competitiveness of business structures and developing a strategy for managing their competitiveness both in the long and medium term are the most important tasks for various economies of the world. It should be noted that the theoretical and methodological aspects of managing competitiveness are studied very one-sidedly. On the one hand, the issues of direct management of quality, cost, and various methods for optimizing them are well studied and continue to be studied by scientists. On the other hand, competitiveness is a complex concept, not reducible to the totality of its particular criteria, including ergonomic methods, namely, a systematic and comprehensive consideration of this problem and the relations formed around it have received insufficient attention. The purpose of the study is to develop scientifically based proposals on the management of the competitiveness of business structures.

Keywords: High-tech products · Business structures ·
Competitiveness assessment · Value indicators

1 Introduction

The most important goal for Russian economy and society development is to preserve, maintain and increase the competitiveness of the business structures that produce high-tech products. At present, the share of high-tech industries in the Russian economy is low. In 2016, this share accounted for only 24% of GDP. According to this indicator, Russia lags behind all the BRICS countries and many Eastern European countries. Domestic business structures are not among the leaders in terms of exports and high-tech products: according to the National Science Council (National Science Board), in 2014, the share of Russia in this indicator was 0.3%–0.5%. Russia's share in the production and export of commercial high-tech services was 2% and 1.6%, respectively. The share of domestic organizations implementing technological innovations in 2016 was only 9–10%, while in the UK - 34%, France - 37% and Germany - 55%. The cost of R&D of industrial companies in Russia in 2016 was only 0.3% of GDP. For comparison, the same indicator in China was 1.54%, in the USA - 1.79%, in Japan - 2.72%.

In 2016, Russia ranked 43rd in the global competitiveness ranking, 32nd in competitiveness and 71st in the competitiveness ranking of companies. Studies have shown that the main reason for the lack of competitiveness of Russian entrepreneurial structures and an obstacle to their development is the unsatisfactory level of quality management of production systems. A single generally accepted methodology for managing the competitiveness of business structures that would take into account all factors of the external and internal environment of technological entrepreneurship, features of high-tech industries and their products corresponded to the modern concept of ensuring the continuity of management of the innovation process at all stages of the product life cycle not developed. Thus, the combination of the stated circumstances determines the relevance of the research topic.

2 Data and Methods

The foregoing problems necessitate processing and implementation of practical proposals aimed at improving the competitiveness of high-tech business. Studies of the competitiveness of entrepreneurial structures producing high-tech products based on process, cost, industry and structural approaches have established that the market has the following features: sharp fluctuations in demand, high dependence on the final product of the industry, primary quasi-monopoly, low elasticity, professional consumer, high share of startups, and dynamism of market participants. Competition in the high-tech market is particularly acute (Table 1).

The specific total of high-tech entrepreneurial structures in the total number of economic entities of the Russian economy has had a negative trend over the past five years. The number of knowledge-intensive entrepreneurial structures annually decreases by more than 23 thousand units. However, the growth of the share of high-tech products in the gross domestic product of the Russian Federation over the entire study period is stable and amounted to 1.4% in 2017 compared to 2012.

Table 1. The dynamics of the main indicators of high-tech products market of the Russian Federation, for 2012–2017.

Indicator	2012	2017	Difference
Number of business structures, thousand units	4888,9	4561,7	−327,2
Number of high-tech business structures, thousand units	503,6	387,7	−115,8
The proportion of knowledge-intensive business structures, %	10,3	8,5	−1,8
The share of high-tech products in gross domestic product, %	20,3	21,7	1,4
Index of product novelty/intensity of competition	8,8	9,3	0,5

The current practice of assessing competitiveness, modification of quality or economic indicators of products does not allow for a full analysis and adoption of effective management decisions by high-tech business structures; since it takes into account only one of the main components of competitiveness. Comprehensive indicators, combining both technical and economic characteristics of products, provide a more objective

assessment of competitiveness, but do not fully allow to evaluate the efficiency of product exploitation, to determine competitiveness in a strategic aspect, taking into account the costs over the entire life cycle of products, business component of competitiveness from the perspective of consumers. Based on the analysis and revealed properties of high-tech industries, the current trend of transition from the market of the manufacturer to the market of the competent consumer, such a measure of competitiveness is not suitable for use as a tool to increase the objectivity of high-tech enterprise structures.

The competitiveness of entrepreneurial structures producing high-tech products should be characterized by operational and business elements, correlated to the costs that the consumer must bear. The elements of evaluating the competitiveness of entrepreneurial structures producing high-tech products should meet the following requirements: multidimensionality, relativity, specificity, dynamism and, most importantly in modern conditions, to enable analysis from the perspective of the consumer. The main ones are quality and value, the beneficial effect of product exploitation, the regulated product usage time at the consumer, total consumer costs for the purchase and operation of products, profits that can be obtained as a result of the use of these products, business efficiency. The carriers of these elements of competitiveness assessment, based on our research, are indicators of operational and business returns.

Studies have shown that methodological approaches to assessing the competitiveness of products for operational and business output, as interpreted by Bratolyubov [1, 2]. It is advisable to supplement the elements reflecting the influence of the specifics of high-tech industries, which include phased development; the speed of obsolescence of innovations; uncertainty of costs, outcomes and other characteristics:

$$KC_{\partial_{in}}(T_{\partial H}, T_{piH}) \Big|_{t_o}^{T_{\partial H}} = \partial_{in}(T_{\partial H}) [Z_{in}(T_{\partial H}, T_{piH})]^{-1}$$

$$\partial_{in}(T_{\partial H}) = F_{iH}(T_{\partial H})$$

$$KC\bar{\delta}_{in}(T_{\partial H}, T_{piH}) \Big|_{t_o}^{T_{\partial H}} = B\bar{\delta}_{in}(T_{\partial H}) [Z_{in}(T_{\partial H}, T_{piH})]^{-1}$$

where $\partial_{in}(T_{\partial H})$ - operational efficiency of high-tech products;

t_o - the beginning of the count, the regulated time of operation of high-tech products of entrepreneurial structures by the consumer (with $T_{\partial} = \text{id e m}$);

$T_{\partial H}$ - the regulated time of operation;

$Z_{in}(T_{\partial H}, T_{pi})$ - total consumer cost during operation; i - high technology products business structures; $T_{\partial H}$ - regulated operation time;

F_{iH} - a function of the value of high-tech products, defined by the author of the proposed scheme, the identification value and the determination of operational and business impact of high technology products business organizations.

The application of these indicators to the competitiveness assessment will provide adaptability and flexibility in the assessment, as it will allow entrepreneurs to evaluate competitiveness throughout the entire product life cycle.

The identification scheme of the competitiveness assessment of entrepreneurial structures producing high-tech products presented in Fig. 1.

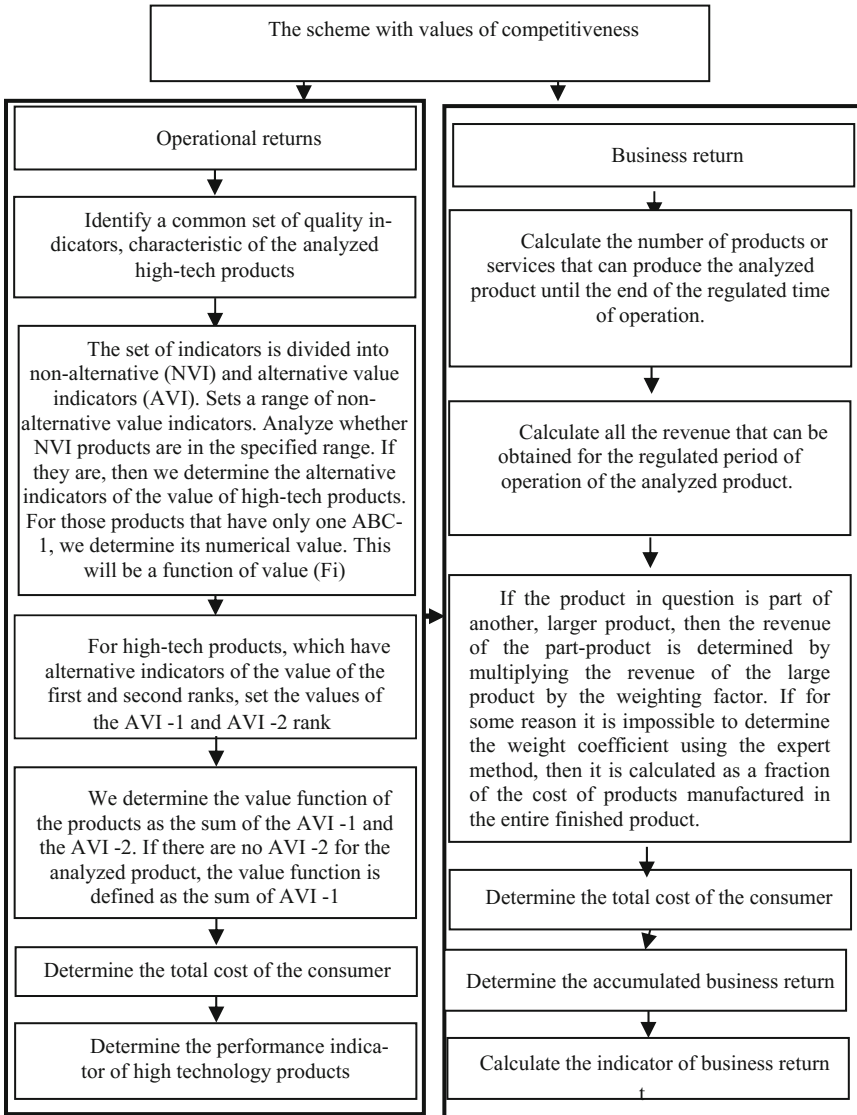


Fig. 1. Schemes with identification of the value of competitiveness of business structures producing high-tech products.

Identification scheme determines the operational and business returns of high-tech products of business structures. It includes determination of value indicators of high-tech products, identification of non-alternative and alternative value indicators, ranking of alternative value indicators, determination of their values, operational returns, the calculation of consumer revenue, the calculation of consumer spending, the definition of business returns [3–6].

3 The Results Obtained

In the process of analysis, it was found that the following approaches to ensuring competitiveness prevail in Russian knowledge-intensive business structures: 1 - superiority of product quality on the market; 2 - prevalence of goods on the market; 3 - minimization of costs and prices. Data on the proceeds, based on certain features of high-tech industries and the necessary orientation on the fourth technological revolution, occurring at high speed and accompanied by increased competition, is not fully suitable for ensuring the competitiveness of the business structures producing high technology products. Authors developed and proposed a new mechanism for information-methodical maintenance of competitiveness of enterprise structures producing high-tech products.

The proposed mechanism provides for the separation of competitiveness management by life cycle stages and the identification of applicants of prospective, planned, potential and market competitiveness of products at each of the selected stages. For each of the selected stages of competitiveness management, methods, information base, structure of responsibility and were determined.

The main principles of the presented information and methodological support are as follows:

- (1) in the systematic identification of the sources of competitiveness risk by means of observation and analysis based on continuously received information;
- (2) strategic planning and rapid response to events according to the functions and distributed responsibility for managing competitiveness, that is, strengthening the competitive forces;
- (3) minimizing unjustified costs, due to the adoption of informed decisions on competitiveness.

Authors marked stage in the information-methodical maintenance of competitiveness of enterprise structures producing high-tech products.

1. Stage long-term planning. At this stage, the market is studied, the consumption sphere, demand and supply for new products, competitors' positions are predicted and analyzed, requirements for new products are indicated, and the integral quality of the object will be required by the consumer. Then, based on the data obtained in the mechanism of information and methodological support, it was proposed to form the concept of the product, develop a plan and standards for prospective competitiveness.

The main management tools at this stage are the methods of strategic marketing in combination with the methods of scientific, technical and economic forecasting. According to the author, the result of the long-term planning stage should be clearly defined requirements for the designed products and indicators of prospective competitiveness, which are transferred to the next stage - the development stage [7].

2. Stage of development. At the stage of development, the developers and designers developed new or improved products. Studies have shown that design and development play a fundamental role in increasing the possibilities of satisfying customer needs, and, therefore, in ensuring the competitiveness of entrepreneurial structures producing high-tech products. In the process of development and design, the planned indicators of quality are determined, the system of valuation is created, the planned cost is determined. It is proposed to determine the indicators of the planned competitiveness of products. Designed as appendices to project documentation, they should be compared with indicators of prospective competitiveness, as well as with indicators of competitors' products. If they are in acceptable values, then we can proceed to the production of products. If the parameters of the planned competitiveness do not correspond to the indicators of prospective competitiveness or have changed over time under the influence of scientific and technological progress or the requirements of consumers, then, in our opinion, it is necessary to develop measures to maintain competitiveness.
 3. Stage of production. This stage involves the involvement of a large number of material and human resources, the calculation of the actual cost, one of the most important indicators, so errors or inattention to previous stages can significantly reduce competitiveness indicators. A mandatory condition for ensuring competitiveness in the production process, which is reflected in the developed information and methodological support, is determining the potential competitiveness of products, comparing it with indicators of competitiveness of previous stages and, if necessary, taking measures to eliminate deviations, if any. The result of this stage is an innovative product produced with indicators of potential competitiveness.
 4. Stage of implementation and maintenance. In the modern world, many consumers are moving from product consumption to service consumption, and the cost of operating products in some cases can be up to 40% of the cost of the product. To maintain communication with the consumer and monitor the operational characteristics of products, it was proposed at the implementation and service stages to determine indicators of market competitiveness that take into account the quality of service, ease of use of the product, that is, the use value of the product is determined. The final competitiveness in the proposed mechanism of information and methodological support of entrepreneurial structures producing high technology products is evaluated only after the implementation and maintenance stage. Indicators of market competitiveness are transmitted for further analysis and management decisions at the first stage of long-term planning.
- Managing the competitiveness of knowledge-intensive entrepreneurial structures represented by the mechanism of information and methodological support of the competitiveness of knowledge-intensive entrepreneurial structures producing high-tech products will facilitate the use of innovative ideas. This will allow achieving

the optimal balance between quality and price of consumption at all stages of the product life cycle, creating consumer value of products, which will correspond to the modern level, approximate 6th technological structure [7]. That will allow business structures to be competitive.

4 Conclusion

The conducted study allowed us to make a number essential and topical clarifications of the content of economic processes to improve the field of development of the theory of entrepreneurship in terms of the formation and development of the system of infrastructure support for entrepreneurial activity, to obtain concrete results, develop recommendations and formulate conclusions.

In modern conditions, entrepreneurial structures that carry out activities taking into account the possibilities of information and methodological support gain additional competitive advantages compared to other market participants, since they not only produce products in strict accordance with consumer needs, but also optimize their own costs of doing business, increasing the level of business performance.

The proposed set of indicators for assessing consumer value, which objectively allows to determine the competitiveness of operational or business efficiency of products per unit of total costs, which is especially important for entrepreneurs. In the developed methodology for managing competitiveness grouping is carried out into a single integrated system of marketing, quality and cost management methods, as well as the methods used in the development and design of products.

References

1. Bratolyubov, V.B.: Competitiveness of industrial products of means of production. *Qual. Manag. Methods* **10**, 4–9 (2007)
2. Bratolyubov, V.B.: The concept and strategy of efficient industrial production in an open market. *Qual. Manag. Methods* **8**, 4–10 (2007)
3. Marakhovskaya, I.Yu.: The mechanism for ensuring the competitiveness of products of high-tech enterprises at all stages of the life cycle. *IScientific Rev. Theory Pract.* **2**, 117–126 (2016)
4. Kuznetsov, V.V., Pakhomov, A.A., Artemenko, D.: Social problems of rural development and staffing. *Sci. Rev. Theory Pract.* **1**, 51–59 (2017)
5. Pakhomova, A., Salnikova, Y., Namestnikova, L.: Methods of ergonomics and social technologies application in small business. In: *Advances in Intelligent Systems and Computing*, vol. 783, pp. 46–54 (2019)
6. Pakhomova, A.: Development of small agrobusiness subjects and governmental supporters. *Econ. Reg.* **4**, 207–212 (2011)
7. Kolbachev, E.: Management of mechanical engineering design processes based on product cost estimates. In: *SHS Web of Conferences*, vol. 35, pp. 1–5 (2017)



Selecting the Business Information Security Officer with ECU@Risk and the Critical Role Model

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Abstract. In all 21st century companies and organizations, human component is the main resource with which one counts, since their development and success will largely depend on it. In securing information activities, the human component becomes a strategic element, as those responsible for its management must know in detail the business model, vision, shared values and strategy. These elements, in addition to an applied organizational style model, will allow a business ISMS to achieve the objectives set. Under this premise, a methodology was applied based on the theory of a 20-step selection process developed by Martha Alles, who summarizes the identification, evaluation, selection, hiring and incorporation of suitable staff, allowing to identify the Business Information Security Officer, as suggested by the ECU@Risk methodology. For this purpose, we analyze the main components that make up the recruitment, evaluation, selection and hiring process. The controls to the fulfillment of the corporate goals, the strategic planning and the models of structure and business culture.

Keywords: Human resources · ISMS · Information security · Critical role

1 Introduction

Since many years ago, having information at the precise moment has meant “power”, and only individuals or groups that were able to finance the exchange of such information took advantage of that privilege. Starting from a generally accepted concept that “information is power”, phrase that is attributed to Francis Bacon, the individual who has the control capacity is not the one who knows where to find a specific data, an historic antecedent, source or material, but the one who grasps the idea on how to use what he have found [1]. It generates the search for information management, many times to take advantage of it for different goals, sometimes of a negative order, generating risks with different impact levels, so therefore it is crucial to protect it because information is one of the most important assets of an organization.

Gómez [2] suggests that information security is based on three basic mainstays: (i) confidentiality: information must be acceded only by granted people or systems;

(ii) integrity: information must be free of unauthorized alterations; and (iii) availability: information must be usable when the business process require it.

Information security management should not be taken as an insignificant activity, as a cost-generating activity, or as a simple reaction to a provision of control entities; but it must be done conscientiously respecting an established protocol. ECU@Risk is a methodology that defines the processes and procedures for information security that must be followed to manage computer risk, focusing on the micro, small and medium-sized enterprises sector - Ecuadorian MPYME [1]. Its construction was based on the study of several widely disseminated methodologies and frameworks: (i) Magerit; (ii) CRAMM (CCTA Risk Analysis and Management Method); (iii) OCTAVE-S; (iv) Microsoft Risk Guide; (v) COBIT 5; and (vi) COSO III; all based on industry best practices: ISO 20000, 27001, 27002, 27005, 31000 and 37000.

In 2018, Pinos and Serrano [3] propose a methodology based on the theory of the 20 steps of a hiring process developed by Martha Alles that summarizes the identification, evaluation, selection, hiring and incorporation of critical personnel to a company [4]. The administration of human resources is an interdisciplinary area, which requires concepts of organizational psychology, labor law and safety engineering. It is necessary to understand both internal and external organizational aspects. They also add that according to Alles, 5 are the basic processes of human resource administration: (i) Integration; (ii) organization; (iii) evaluation; (iv) development; and (v) retention [3, 4].

Although all charges are considered important for the operation of a company, some are more critical than others are; and for these to be defined as such, will depend on the contribution they provide to the organization, as well as the performance of those who hold the positions, and not necessarily those with higher hierarchy. ECU@Risk, within its processes, suggests that an Information and IT Risk Management Committee should be established. This requires the identification and incorporation of key personnel for these activities that are part of a critical process, among which is the Information Security Officer, since some decisions on the treatment of information and countermeasures depend on them. They will face the various threats inherent in the environment [5].

This paper evaluates the result of the application of the combination of the methodology of critical positions and methodology ECU@Risk in an organization of the city of Cuenca. This section details the 5 sections that comprise it, divided as follows: (i) State of the art, which indicates the theory that supports the selection of critical positions for the management of information risks and the work related to this topic. (ii) The applied method that explains the procedure for selecting the tools that were used; (iii) The analysis of results; which details the experience gained with the use of the combination of tools proposed by the ECU@Risk methodology and the methodology for selecting critical positions; (iv) Discussion of the results; and (v) Conclusions.

2 State of Art

According to Oz [6], 21st century organizations maintain information systems, technological resources that are formed by data, hardware, software, telecommunications, human resources and the procedures or rules necessary to achieve optimal and safe

operations. In addition, it suggests that there are four stages in processing: (i) entering data into the system; (ii) modify and manipulate the data, or data processing; (iii) extraction of information from the information system; and (iv) storage of data and information; but, like all organizational resources, these must be managed. Rue and Byars [7] indicate that the starting point of an administrative process is the determination of the objectives of the organization, elements that are designated to its members to give an address and purpose. They also state that administrators cannot guide or direct people efficiently if the objectives have not been well defined.

In four levels, administrative functions are summarized: (i) Planning, which is deciding in advance what, when, why, how and who. (ii) The organization, which consists of group activities, assignment activities, advice, and provide the authority for the execution of the activities; (iii) Motivation, that is, how to direct or channel human behavior towards well-defined goals; and (iv) Control, evaluate performance, determine the causes of deviations, if any, and take corrective actions when required [7].

Because the administrative process involves guiding or directing people, it is important to understand the sciences of human behavior and other behaviors such as leadership, group activities and conflict management [7]. Functional and behavioral management are not mutually exclusive, as an administrator should fully understand the work, he/she is going to perform (administrative functions) and the people to be administered (behavioral sciences). Thus, both approaches must be considered as necessary and complementary.

For Caicedo and Acosta [8], the management of human talent is “the system in charge of establishing the necessary conditions for people to grow integrally within the organization and contribute to the permanence of it”. While for Dessler and Valera [9], the administration of human resources “is the process of hiring, training, evaluating and remunerating employees; as well as attending to their labor relations, health and safety and aspects of justice”.

The fusion point between the theory of administration, the sciences of human behavior and the technologies of the information relapses in a business necessity: to reduce the costs to generate competitive advantage; and all this comes together when the demands of IT management and the dangers of introducing new technologies at the center of work have created the complexity of innumerable proportions [10]. The IT staff often feels pressure for the departmental activity itself and for the evolution of the business.

ISACA [11] mentions that successful companies have recognized that the committee and executives must accept IT like any other important part of doing business. The committees and the management, both of IT and of the organization, must work together to fulfill management and government actions, and respond to market needs, to dispositions of regulatory bodies and their stakeholders. In addition to these needs, a critical factor is added: the information management of the multiple systems, product of the large amount of data that these devour process and convert into useful information, information that can be used by third parties to excel if this was disclosed or accessed by unauthorized personnel or systems.

TUBERIA GALVANIZADA DEL AUSTRO S.A. (TUGALT), part of the GRAIMAN INDUSTRIAL GROUP, is a leading company in the manufacture of steel pipes, roofing and galvanized products, as well as other complementary products.

Founded in 1963, it has gone from being a family business to a company of institutional cut. Committed to the country and the region, it currently has an extensive network of distributors strategically located to serve its customers throughout the country; among its main products are black and galvanized pipe, zinc plates, profiles, collaborative plates and trapezoidal roofs made under technical standards and manufacturing standards [3].

3 Method

ECU@Risk methodology is based on 5 ISO standards: (i) 27001; (ii) 27002; (iii) 27003; (iv) 31000; and (v) 37000; also considers the best practices of 4 methodologies: (i) Magerit; (ii) CRAMM; (iii) Octave-S and (iv) Microsoft Risk Management; and it is also projected to the COBIT 5 and COSO III governance frameworks, considering the Ecuadorian laws and regulations [5]. This methodology includes 4 sections: (i) introduction to risk management; (ii) the risk management framework; (iii) the risk management process; and (iv) resources. In order to identify those responsible for information risk management in the organization, it focused on Sect. 2 of the methodology (the risk management framework), intending: (i) to identify the designated security officer or coordinator. (ii) The process of selecting the members that will be part of the Information and IT Risk Management Committee. (iii) And the personnel designated to form the IT Certification Committee.

To support this identification of positions, roles and responsibilities, the methodology for selecting critical positions was applied considering its six stages: (i) Reception of the personnel's request and analysis of the profile of the position. (ii) Selection of recruitment sources. (iii) Receipt of resumes, presentation and interview with candidates. (iv) Application and analysis of psychometric tests; (v) preparation of the psycho-labor report. (vi) Final interview with the general management.

The profile of Information Security Officer's role who will be part of these Committees is based on the competency dictionary of Spencer and Spencer, a model that has previously been used in other organizations of the GRAIMAN business group. Its objective is to allow all the collaborators of the GIG (acronyms of the GRAIMAN INDUSTRIAL GROUP) to have a common vision of the necessary competences to obtain the required results; in addition to reinforcing the GIG culture and simplifying coordination with respect to Human Resources activities within the organization.

In establishing the committees, the Interview Guide, proposed by the critical positions methodology was considered, and it implies: (i) personal image: punctuality and personal presentation; (ii) training: academic level and training received; (iii) work experience: similar functions performed in other institutions and the reasons why the candidate wanted to belong to the committee; and (iv) the skills detected in the interview, such as listening skills, speech articulation, and confidence and trust.

4 Results

The first phase of the methodology for selecting critical positions regarding the receipt of personnel requirements and profile analysis allowed to identify, in a designated format, the organization's human resources that will be part of the information management: (i) the designated security coordinator; (ii) information owners, that is, those responsible for managing and approving access to it: Research and Development Management; Production management, and Commercial Management; and (iii) the owners of the information systems, personnel that are part of the Information Technology Department, responsible for implementing and ensuring that the appropriate controls are implemented and functioning.

As required by the methodology of selection of critical positions, this personnel request form was delivered to the Selection Analyst of TUGALT S.A. with the signatures of approval of the Immediate Chief, Area Director, Administrative Director and the reception signature of the Selection Analyst. In addition to the form, the charge profile was attached where all the data related to the required position was indicated in detail, focused on covering the company's need from end to end and aligned with the objectives of the business strategy.

To design the profile of each of the identified roles, the Competency Model was used, which, under the Organizational Model and its shared values, allowed to established as minimum competencies to consider or develop: (i) a strategic behavior; that is, designing and executing the activities that will support the fulfillment of the objectives and strategies in relation to the assurance and management of the information; (ii) customer service training, since those responsible for this management must be able to detect the needs of internal and external clients, doing what is necessary to satisfy them; (iii) teamwork, formulating a collaborative space and supporting their co-workers in achieving the objectives set; and (iv) mentoring; that is, to design and execute activities aimed at fostering the development of the competencies of the organization's personnel in terms of security and information assurance.

In phase 2, corresponding to the selection of recruitment sources, we took four steps: (i) analyze the position's complexity; (ii) identify the source of recruitment according to the position's complexity; (iii) consider informal sources as referrals and (iv) strengthen the analysis through formal sources. To complement these steps, we identified the economic sector to which this organization belongs; in this case, the construction sector. In addition, we created a list of the companies that are part of this industrial sector and added to the parameters established by ECU@Risk, which allowed us to identify all business areas that generate value to the processes.

From resumes of all possible candidates received between April 15th to the 30th of 2018, we pre-selected those that met the required profile: (i) security officer or security coordinator in charge, whose profile was technical, security specialist IT and process management; (ii) Information and IT Risk Management Committee, with knowledge of administrative processes, as they will be mainly responsible for coordinating security decisions, policies, rules, risk analysis, continuity of service plans, disaster recovery; establish a plan for periodic security reviews of the organization, and approve security policy measures; (iii) Certification Committee, made up of technical and non-technical

personnel, in charge of reviewing and approving the conditions and certification criteria, certifying any acquisition, change or deregistration in the computer system, and promoting within its scope the application and development of the evaluation of compliance; (iv) owners of information, which are the managers of each area or division.

The structure considered by the Information and Risk Management Committee and the Information Technology Department will be as follows: (i) the Presidency, will be taken on by TUGALT S.A. Service Center Manager; (ii) The company’s Business Information Security officer will act as Secretary; (iii) departmental managers: Development and Research; Production, Sales, Logistics; and an internal auditor. On the other hand, for the IT Certification Committee: (i) The Service Center Manager will take on the Presidency; (ii) the Business Information Security Officer will take on the Vice Presidency; the CEO’s assistant will act as the Secretary; (iii) the Internal Auditor will act as the Observer; (iv) the members, designated by the area management, and according to the process that is affected by the project.

In the fourth phase, we took into consideration the application and analysis of results on psychometric tests and competence. For such, candidates that most closely matched the required profile were evaluated. Through “Evaluate”, the evaluation platform of TUGALT S.A., the following tests were carried out: (i) Specific Competences; (ii) Intelligence; (iii) Personality; and (iv) Technical, prepared by the immediate Chief. From three candidates presented, only one fell within the established parameters, as indicated into Fig. 1:

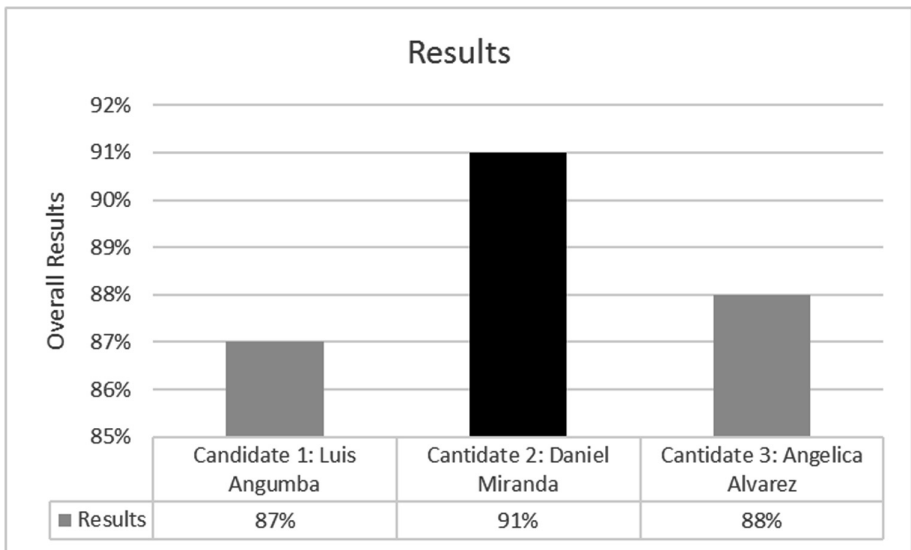


Fig. 1. Results obtained in evaluation process (black color indicates the profile that most closely matched that of for the position).

5 Discussion

In the development by competences, mentoring is fundamental, because the management team must establish strategies to develop and improve team spirit, encouraging and motivating the rest of the team members. As Alles [4] indicates in regards to organizational development [that it] “involves the whole organization so that change can occur”, information security also requires the commitment of the entire organization for cultural change to happen, recognizing the effort that top management must achieve for this purpose in the directional style, as indicated by Crespo [5] in his work on a methodological proposal for ECU@Risk.

IT Risk Management Committee members should evaluate technology and information risk planning, and monitor performance management, including the information security components; therefore, the decisions taken in this area must be based on an adequate risk management program, and so it is required that the methodology for selecting critical positions consider roles and knowledge about government and technological management, as well as process management.

Every organization should include a policy that establishes the need of a Risk Management Committee for information and information technologies, which commits to all the members of the organization, so that it identifies all those responsible for ensuring compliance and to be widely known in the organization; activity that is related again with what Alles indicates in his methodology: “The organizational development coordinates the interaction between the different parts of the organization for the effective working relationship between people, as well as towards the structure and processes efficiently”. The appointment, renewal or cessation of both the presidency and the vice-presidency and secretary of the committees shall be in full of its members.

The decision making in the plenary session of the committee is made as far as possible by consensus. If the consensus is not reached, the procedure is used by voting, taking into account that there will be one vote per sector, and the agreement that reaches the simple majority of the sectors represented will be valid. The agreements related to the development of the works or the approval of documents are recorded in the minutes drawn up at each meeting. The purpose of establishing these committees is again related to what Alles indicates [4]: “Build work teams that provide cooperation and contribute to overcome individual and group differences”; in this case, building a team committed to the analysis of threats and risk management to make decisions that guarantee the availability, reliability and integrity of the information is key in the business processes.

Phase 2 of the methodology for selecting critical positions should be updated with a selection not only of companies, but of candidates from the company, based on the various departments, and especially those that are part of strategic processes, because many times in a company there is no talk of external selection but rather of internal preparation and escalation.

The methodology of selection of critical positions indicates that a list of the companies that are part of this industrial sector must be generated; however, by aligning what ECU@Risk requires, it allowed to identify all business areas in order to recognize those that are strategic and contribute positively to the generation of value.

The selection of the person in charge of security should not be solely based on academic preparation, but also on experience and, above all, on a technical knowledge level. A technology professional who has obtained academic achievements will not necessarily develop fully in the performance of his position if he/she is not constantly updating, so in the methodology of selection of critical positions this point should be considered.

Unlike the experience acquired in TUGALT S.A., the support of an external consultant for this process may be important, since many organizations in the MSME sector neither have human talent management specialists, nor in process management or information security management, which agrees to what Alles [4] and Ruano [12] suggest: *“To employ one or several agents of change”*, that could be external consultants, and the leader of the human resources area.

6 Conclusions

The ECU@Risk methodology suggests the incorporation of individuals that will be part of a team responsible for the control and monitoring of security activities and information assurance; however, in combination with the proposed methodology for selection of critical positions, we could clearly identify the required profile, and matched it with that of the candidates that underwent psychometric tests and a rigorous selection process, thus allowing us to identify and select the Information Security Officer, as part of the personnel that will constitute the Committee of Information and IT Risk Management, and that of the IT Certification Committee.

Although the methodology for selection of critical positions helped us to select the position it is important that, within the same process, personnel escalation and internal selection be considered, because a company usually focuses in external selection; However, it is flexible, as Alles suggests: *“Organizational development is flexible and adapts to the different needs of the organization”*. On the other hand, the methodology for information risk management ECU@Risk does not define in detail the assurance techniques that the profile of the Information Security Officer should maintain. Nevertheless, its affinity with ISO 27001 allowed us to recognize that among its abilities it should be considered: (i) the technical knowledge to face a computer attack, either by hardware, software or communications; (ii) the technique of social engineering and (iii) the process management.

The administration of human resources has great influence on both individuals and organizations, which depends on the way candidates are selected, integrated and guided to carry out their work, as well as to develop, evaluate and reward them. While human resource management has a global impact on organizations, organizational development seeks to transform them through changes in their culture, sharing individual and organizational objectives and through its three stages of data collection, diagnosis and intervention [13].

Finally, we can conclude that the Information Security Officer selection depends not only on the evaluation of resumé or on the academic level obtained. It must go through a rigorous selection process, which is subject to various types of techniques such as those cited in this article.

References

1. Crespo, E.: ECU@Risk. Cuenca, Azuay (2017)
2. Gómez, A.: Enciclopedia de la seguridad informática. Alfa-Omega, México (2011)
3. Serrano, M., Pinos, M.: Propuesta metodológica para la selección de cargos críticos. Caso aplicado: TUBERÍA GALVANIZADA S.A. (TUGALT). Universidad del Azuay, Cuenca, Azuay (2018)
4. Alles, M.: Selección por Competencias. Granica, Buenos Aires (2017)
5. Crespo-Martínez, E.: Metodología de Seguridad de la Información para la gestión del Riesgo Informático aplicable a MPYMES. [Art]. Universidad de Cuenca (2016)
6. Oz, E.: Administración de los sistemas de información. Cengage Learning, Mason (2008)
7. Rue, L., Byars, L.: Administración, teoría y aplicaciones. Alfaomega, México D.F. (2006)
8. Caicedo, V., Acosta, A.: La gestión del talento humano y el ser humano como sujeto de desarrollo. Revista Politécnica, no. 14, pp. 105–113 (2012)
9. Dessler, G., Valera, R.: Administración de Recursos Humanos. Enfoque latinoamericano, Pearson (2009)
10. Mahajan, R.: Administración de TI: Administración de TI en una recesión, sugerencias para la permanencia. <https://technet.microsoft.com/es-es/library/ff956121.aspx>
11. ISACA: Un Marco de Negocio para el Gobierno y la Gestión de las TI de la Empresa. ISACA® Framework, Madrid (2012)
12. Ruano, J.: La selección de personal en las nuevas organizaciones: Externa vs Interna. Universidad de Valladolid, Nuevas tendencias (2014)
13. Chiavenato, I.: Administración de Recursos Humanos. McGraw-Hill, Colombia (2009)



Computer-Aided Occupational Risk Assessment of Physical Workload in the Logistics 4.0

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Abstract. Background: The fourth industrial revolution entails many changes, e.g. in logistics, needed employees' skills. Current society is also changing, because of increasing life expectancy, globalization. The non-simultaneous modernization, caused by different economic situation in every country, needs agile and adequate solutions to protect health and safety of employees. Objectives: To overview the methods of assessing physical workload with emphasis on the suitability for intralogistics tasks in the context of Industry 4.0, Logistics 4.0 and following demographical changes. Methods: A critical review of the literature currently available on this topic. Results: There are many methods adjusted to assess physical workload of intralogistics workers besides of the one dedicated them. Only a few of them are implemented in computer applications based on DHM. Several allow modeling different populations.

Keywords: Human factors · Ergonomics · Industry 4.0 · Logistics 4.0 · Occupational hazard · Physical workload · Work-related MSDs

1 Introduction

In the age of Industry 4.0 and Logistics 4.0 enterprises aim to use more solutions based on process automation than human work. For entrepreneurs in some countries including Poland, it is still too expensive. According to International Federation of Robotics the number of installed industrial robots per 10,000 employees in the manufacturing industry is still growing. In 2017 the worldwide average robot density was 85 units. By regions it was 106 units in Europe, 91 units in both Americas and 75 units in Asia. The highest rate in Europe was in Germany – 322 units per 10,000 workers [1]. In comparison in Poland in 2016 it was 32 units (then the average worldwide rate was 74) [2]. The automation is a great chance, unstoppable and necessary development but a great hazard in the same time. Workplaces with the simplest tasks will be substituted by robots as the easiest way to implement elements of Industry 4.0, but later the human work will be much more reduced. Instead of that the easiest work, will appear works for engineers to design and manage the digital twins of manufacturing systems, supply

chains. We will need to teach and learn new, more complex skills and computer programs [3]. Employment structures will be much deeper divided reliant on economics of a country between countries with higher and lower rate of automation. In countries where the automation will be leading, older and disabled people will have even bigger problems with getting jobs adjusted to their possibilities and qualifications [4]. We cannot forget about global increasing life expectancy. For companies which cannot afford investment in high technologies attractive is still human workforce [5], including emigrants. Finally employees could be represented by a wide age range and populations from all over the world. The occupational risk assessment is obligatory and the methods should be appropriated to the employees and their tasks. That makes necessary to be equipped with a proper modern, computer applications which will help to manage occupational health and safety of all the workers [6]. The purpose of the article is to provide an overview of the most adequate methods of assessing physical workload with emphasis on musculoskeletal overload of intralogistics employees with a review of the most popular English-language computer applications for those methods and guidelines determined by requirements of changing model of industry and society.

2 Industry 4.0 and Logistics 4.0

The increasing use of Information and Communication Technologies (ICT) has led to changes in many areas of our lives, not only in society but also in industry. It had led to begin the fourth industrial revolution. The term “Industry 4.0” was introduced in Germany at the Hannover Messe at 2011 [7]. The main purpose of Industry 4.0 are smart factories, which work based on networking, mobility, flexibility and broadly defined integration with customers and suppliers. These intelligent networks use Cyber-Physical Systems (CPS), e.g. web, cloud technology. Many well-known applications like Enterprise Resource Planning (ERP), Warehouse Management Systems (WMS), Transportation Management Systems (TMS) and Intelligent Transportation Systems (ITS) are applied. Even more devices are helping to get information in real time, such as sensor networks, drone points, business intelligence systems [8]. They are working in connections forming Internet of Things and Internet of Services, where all of them together can create the Smart Factory [9]. Closely connected with the change of Industry are changes in Logistics and making Supply Chain Management even more efficient [10]. That gives rise to term Logistics 4.0 [11]. The main domains of modern logistics are mostly technological applications: Resource Planning, Warehouse and Transportation Management Systems, Intelligent Transportation Systems and Information Security [8, 12]. Significant for Industry 4.0 and following it changes is a decreasing amount of employees with lower qualifications. Simple, repetitive tasks will be substituted by robots and intelligent systems [13, 14]. One of example are tasks connected with work of autonomous forklifts planning they path [15].

2.1 Obstacles of Industry 4.0

Implementation of Industry 4.0 is supported by many governments (United States, Japan, in Europe especially in Germany). However it is not an ordinary movement [8]. It can be a reason, why the percentage of enterprises with implemented solutions of Industry 4.0 is different along many countries. Figure 1 presents the main obstacles in implementing Industry 4.0 in Germany according to the survey conducted among 277 companies mostly from mechanical engineering, plant engineering and construction, the electronic and the automobile industry. The results show that on the first and second places are lacking knowledge of the executives and the employees. The long amortization time or to high costs are less difficulty. On the last position is the problem of unavailable solutions and technologies [16]. However, the term Industry becomes familiar. In research made by Müller, Buliga and Voigt [17] among 68 manufacturing SMEs headquartered in Germany, all of the interviewees acknowledged, that if the companies do not change accordingly, they will be driven out of the market by more advanced competitors.

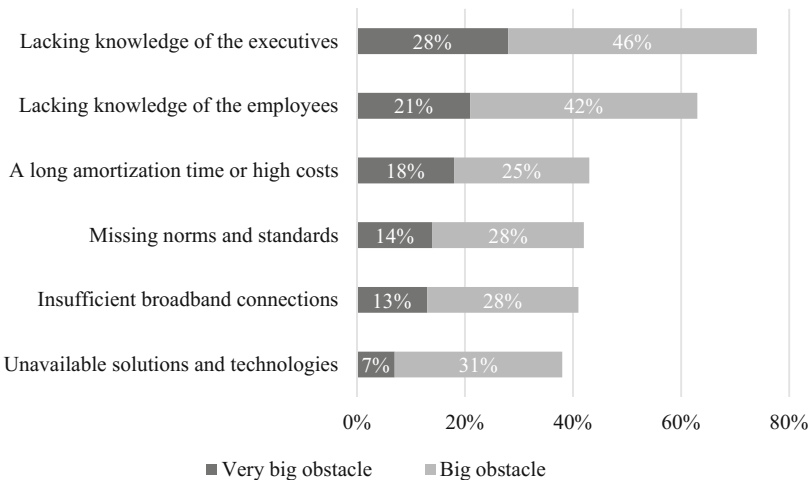


Fig. 1. Obstacles on the path to Industry 4.0 in Germany [16]

On the other side we have got other countries, where the barrier of costs is much more troubling. In Fig. 2 there are results of survey conducted among companies from Poland and Czech Republic. The research was made based on only completely answered questionnaires which sent back 24 enterprises from Czech and 18 from Poland. Most of them were big and middle companies (accordingly 66,7% and 25% from Czech Republic, 50% and 28% from Poland). Most of them were from

automobile (Czech – 29%, Poland – 28%) and mechanical engineering industry (Czech – 25%, Poland – 22%). In this case high costs are in the lead [18]. The same obstacles as above (in Germany - lack of properly qualified staff, in Poland - high financial investment requirements) are presented in research by Ślusarczyk [19]. Another issues like low awareness, insufficient training could be probably eliminated or reduced with larger budget. According to European Commission, the key barriers for Poland are low awareness level among SMEs, long legislative process and the complexity of establishing a mechanism supporting SMEs financially in implementing new technologies. There is also planned budget for The Industry Platform. It will have two budgets (preparation phase and implementation phase); EU funds will be used for market transformation [20].

The SMEs is the sector where these issues build boundaries in particular. Obviously, intralogistics plays important role not only in manufacturing enterprises, but then it is easier to get the connection with Industry 4.0 and then to transform it following modern trends. However, in Poland SMEs are 99,8% of all companies. 2,012 million enterprises create 69,2% of all workplaces – 6,7 million people are employed there. On the one hand Poland has one of the most dynamic economy in European Union, on the other hand its Digital Economy and Society Index (DESI) is on 23rd place among 28 members of UE [21]. That means, the employers have a potential to growth, but the entry into Industry 4.0 using advanced technologies has to wait. However, it does not mean that the computer applications cannot be used as a support e.g. occupational risk assessment.

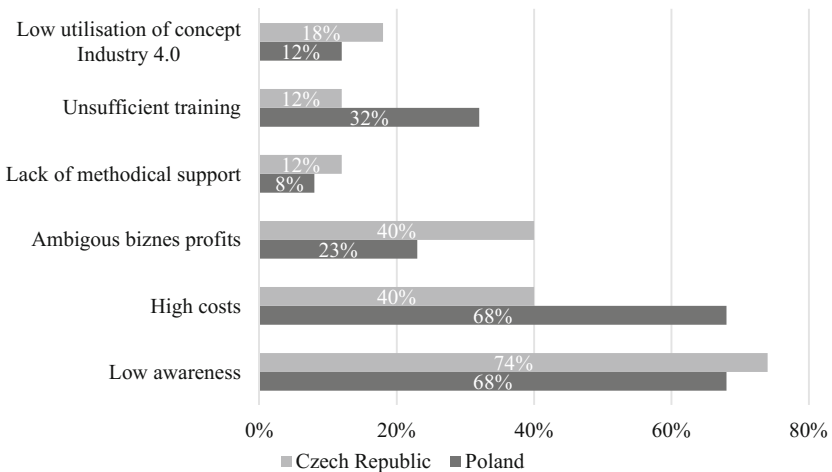


Fig. 2. Obstacles on the path to Industry 4.0 in Czech Republic and Poland [18]

2.2 Changes of Industry and Society

New technologies are seen as great changes giving many profits in quality and flexibility for producers but also connected with them suppliers and clients. Despite numbers of advantages, a lot of changes and possible disadvantages should be taken into account. Companies who cannot afford big investments will be starting from the automation simplest tasks, what will be not beneficial for older and disabled people. The recent researches show life expectancy increases globally. According to European Commission in 2060 will be almost the same number of people in working age as the sum of people over the age of 65 or under 19 [22]. The life expectancy in Poland for men born in 2008 was ca. 76 years and 82 years for women. In 2050 it is forecasted to be 81 for men and 86 for women. In comparison to other countries, it is expected that women born in 2050 in Germany will live 87 years, in Japan 91 years and 86 in United States of America. For men these numbers are accordingly 84, 85 and 83 [23]. When the simplest tasks (which could be done by the group of people over 65 years old and disabled) will be automated, jobs conducted by those people until this time, will start to disappear. There will be a growing problem of employment of these groups. The entrepreneurs will have to start finding other solutions to employ them. The other workplaces should be redesigned to their needs and possibilities. By designing it has to be remembered about globalization. More emigrants are coming because of many reasons. According to European Commission the net migration rate in 2016 only for EU-28 was over 1,3 million people^{1,2}. That fact makes important to design about a possibility to think about anthropometric differences between people from another countries.

3 Methods of Assessing Physical Workload

The analyse of methods and tools has been conducted based on literature review paying special attention to ability of use it for estimation of the level of physical stress and musculoskeletal disorders (MSDs) risk. In Table 1 there are mostly methods which can be used without special measuring equipment (“pen and paper” methods). Many of them are invented and developed to use mostly by researchers, occupational safety/health practitioners or both of those groups [24]. In Table 2 are collected computer applications where digital human model (DHM) has been implemented and reviewed if they are useful to assess tasks of intralogistics employees. During the analysing it has been checked, if the computer application gives an opportunity to choose a population being tested.

¹ http://appsso.eurostat.ec.europa.eu/nui/show.do?dataset=migr_emi1ctz&lang=en.

² http://appsso.eurostat.ec.europa.eu/nui/show.do?dataset=migr_imm1ctz&lang=en.

Table 1. Methods and tools for estimating the level of physical stress and MSDs risk for intralogistics employee

Name of a method	Tasks	Needed parameters
ACGIH TVL HAL (The American Conference of Governmental Industrial Hygienists threshold limit value for hand activity level) [25]	Tasks related with musculoskeletal risks of hand, wrists and forearms	Repetitiveness and duration of hand motion (speed/pauses), needed hand force
ACGIH TVL Lifting (The American Conference of Governmental Industrial Hygienists lifting threshold limit values) [26]	Lifting, repetitive movements	Duration, frequency, vertical and horizontal zone (location of the hands), load weight (as a result)
ART (Assessment of Repetitive Tasks) [27]	Repetitive tasks of upper limbs	Frequency, hand force, head/neck posture, back posture, arm posture, wrist posture, hand/finger grip, breaks, work pace, obstacles, duration
EAWS (Ergonomics Assessment Work-Sheet) [28]	Lifting, lowering, carrying, holding, pushing, pulling	Joint position, special load situations, working posture, action forces with duration/frequency, weight of load, repetitive movements of the upper limbs
Keyserling's checklist – awkward postures of the legs, trunk and neck [29]	Tasks associated with awkward positions of lower extremities	Positions of: trunk, neck, legs, frequency
KIM-LHC (Key Item Method for Lifting, Holding, Carrying of loads) [30]	Lifting, holding, carrying	Number of lifting or displacement operations/total holding duration/overall length of carrying per shift, effective load, posture/position of load, working conditions
KIM-MHO (Key Item Method for Manual Handling Operations) [31]	Manual material handling	Total duration of manual handling operations per shift, type, duration and frequency of force exertion, force transfer/gripping conditions, hand/arm position and movement, work organization, working conditions, body posture

(continued)

Table 1. (continued)

Name of a method	Tasks	Needed parameters
KIM-PP (Key Item Method for Pushing, Pulling of loads) [32, 33]	Pushing, pulling	Number of pushing and pulling over short distances or frequent stopping/total distance of pulling and pushing over longer distances per shift, load weight, industrial truck/aid by rolling or sliding, body position, speed of motion, working conditions, sex of an employee
MAC (Manual Handling Assessment Charts) [34]	Lifting, lowering, carrying, team handling operations	(depending on task) Load weight, frequency, hand distance from lower back, vertical lift, torso twisting, sideways bending, posturer constraints, grip on the load, asymmetrical torso or floor surface, carry distance, obstacles on route, environmental factors, communication
ManTRA (Manual tasks risk assessment) [35, 36]	Tasks associated with whole body musculoskeletal risk, repetitive movements	Total task's duration, repetition (duration, cycle time), exertion (needed force, speed), awkwardness (deviation from the mid-range of movements), vibration; divided between lower limbs, back, neck/shoulders, arms/wrists/hands
MAT (Manual Handling Assessment Tables) [37]	Lifting, holding, carrying	Sex of an employee, load weight, body posture, frequency/duration/distance, working conditions
New Zealand code of practice for material handling [38]	Manual material handling	Risk scores: load, posture and workplace layout, work conditions and environment, time
NIOSH (National Institute of Occupational Safety and Health lifting equation) [39]	Lifting, lowering	Weight of loads, horizontal location, vertical location, distance of travel, asymmetric angle, frequency rate, coupling
OCRA (A concise index for the assessment of exposure to repetitive movements of the upper limbs) [40]	Tasks related with upper limb disorders, repetitive movements	Positions of upper limbs, frequency, duration, obstacles, breaks, needed force

(continued)

Table 1. (continued)

Name of a method	Tasks	Needed parameters
OWAS (Ovako Working Posture Analysing System) [41]	Tasks related with whole body musculoskeletal risks	Positions of: trunk, upper limbs, lower limbs, load weight, sex of an employee, duration
PATH (Posture, activity, tools and handling) [42]	Tasks related with whole body musculoskeletal risks, non-repetitive	Positions of: trunk, neck, legs, arms, load weight, activity, duration
PLIBEL (Method Assigned for the Identification of Ergonomics Hazards) [43]	Tasks related with whole body musculoskeletal risks, repetitive movements	Body posture, tiresome movements, poor design of tools/workplace, stressful conditions
QEC (Quick Exposure Check) [44]	Tasks related with whole body musculoskeletal risks	Positions of: back, shoulders/arms, wrists, neck, frequency, load weight, duration, stress, vibrations, visual demands
RAPP (Risk Assessment for Pushing and Pulling) [45]	Pushing, pulling	Equipment and its condition, load weight, posture, hand grip, work pattern, travel distance, floor surface, obstacles on route, other obstacles
REBA (Rapid Entire Body Assessment) [46]	Tasks related with whole body musculoskeletal risks	Positions of: trunk, neck, legs, upper arms, lowers arms, wrists, needed load/force, quality of handle and grip, static/repetitive actions, stability of body
RULA (Rapid Upper Limb Assessment) [47]	Tasks related with upper limb disorders, repetitive movements	Positions of: upper arms, lower arms, wrists, neck, trunk, legs, muscle use (static/repetitive), force/load (weight, static/repetitive)
SI (Method to Analyze Jobs for Risk of Distal Upper Extremity Disorders – Strain Index) [48, 49]	Tasks associated with distal upper extremity disorders, repetitive movements	Intensity of exertion, duration of effort, frequency, hand/wrist posture, speed of work, duration of task
Snook and Ciriello Lifting Tables [50]	Lifting, lowering, pushing, pulling, carrying	Reaching height, load weight, distance of lift/carry/push, frequency, sex of an employee, push point
WISHA Lifting Calculator (Washington State Department of Labor Industries lifting calculator) [51, 52]	Lifting, lowering	Load weight, body position and twisting angle, frequency

Table 2. Computer applications and programs for estimating the level of physical stress and MSDs risk for intralogistics employee

Name of a tool	Author	Used method(s)	User-defined manikins/population
Alaska/Dynamicus [53]	Institute of Mechatronics, Chemnitz University of Technology	EAWS, RULA	Percentile
DELMIA (modules: DELMIA Ergonomics Analysis (EGA), DELMIA Ergonomics Evaluation (EGE)) [54]	Dassault Systemes (3DS)	RULA, Lifting and Lowering Analysis, Push, Pull and Carry Analysis, Biomechanics Analysis	Population
EMA (Editor Menschlicher Arbeit) [55, 56]	imk automotive	EAWS (OCRA, NIOSH are planned to be implemented)	Percentile
JACK [57, 58]	Siemens	NIOSH, RULA, OWAS, Jack Static Strength Prediction based on 3DSSPP by University of Michigan	Percentile
RAMSIS (Rechner-unterstütztes mathematisch-anthropologisches System zur Insassensimulation) (NASA, REFA, NIOSH module for RAMSIS Automotive) [59]	Human Solutions	NIOSH, REFA Analysis, NASA Discomfort Analysis, maximum force forecast	Population
VERITAS (Virtual and Augmented Environments and Realistic User Interactions to Achieve Embedded Accessibility Designs) [60]	Project granted by EU and coordinated by Fraunhofer Gesellschaft zur Förderung der angewandten Forschung	RULA, REBA, LUBA, OWAS, Snook and Ciriello Lifting Tables	Percentile
3D Static Strength Prediction Program [61, 62]	University of Michigan Office of Technology Transfer	Equation 3D Static Strength developed by University of Michigan, based also on NIOSH	Percentile

4 Discussion

The study showed there are many methods which focus on tasks associated with whole body and upper limbs musculoskeletal risks, manual material handling tasks in general. The amount of methods which consider lower extremities or team handling operations is much smaller. There are some methods dedicated especially for intralogistic operations: lifting, lowering, pushing, pulling, carrying and they are often a basis for another methods. None of them is taking an age of a worker as a factor, just a few are taking into account a sex of a worker.

Among computer programs and applications, the solutions based on DHM increase popularity. However standard worksheets and calculators of physical workload are easy to use, the modern applications are implementing the most popular methods (i.a. RULA, OWAS, NIOSH) giving possibility to use a model of a worker and build his workstation layout (Jack, DELMIA). It helps in design or redesign stage of organisation and optimisation of a workplace. Just one of the programs allows to determine a model as a person with disabilities or diseases (VERITAS). Using two of them (DELMIA, RAMSIS) a user can choose a population for which the anthropometric data are applied.

5 Summary

The Industry 4.0 and following Logistics 4.0 are inducing many modifications, giving the whole populations opportunities and hazards in the same time. The most important aspects which should be considered in designing workplaces in the future due to changes in technology and society are hard to find in existing tools. Different countries have different regulations, but some norms and standards are common. They and the physiology guidelines should define requirements for workplace and its organisation. Heavy and exhaustive tasks of intralogistics workers are getting much more automated but it is not possible in every case [63]. It is important to remember not only about physical but also psychic workload. Monotonous, repetitive and often three-shifted work is overloading not only mentally but also accelerating physical overloading and increasing risk of injury. To estimate the psychic workload can be use e.g. NASA Task Load Index [64].

The review has shown the list of most important methods and most popular computer programs to evaluate the risk and help to optimize intralogistics workstations. The list is non-exhaustive, but shows the possibilities and lacks. In future researches the authors are going to focus on entrepreneurs' awareness of computer-aided occupational risk assessment of physical workload.

References

1. International Federation of Robotics. <https://ifr.org/ifr-press-releases/news/global-industrial-robot-sales-doubled-over-the-past-five-years>
2. International Federation of Robotics. <https://ifr.org/ifr-press-releases/news/robot-density-rises-globally>
3. Maczewska, A., Polak-Sopinska, A., Wisniewski, Z., Krason, P.: The concept of teaching modeling and simulation of manufacturing systems. In: Goossens, R. (ed.) *Advances in Social and Occupational Ergonomics*, AHFE 2018. *Advances in Intelligent Systems and Computing*, vol. 792, pp. 87–96. Springer, Cham (2019)
4. Wrobel-Lachowska, M., Wisniewski, Z., Polak-Sopinska, A., Lachowski, R.: ICT in logistics as a challenge for mature workers. Knowledge management role in information society. In: Goossens, R. (ed.) *Advances in Social & Occupational Ergonomics*, AHFE 2017. *Advances in Intelligent Systems and Computing*, vol. 605, pp. 171–178. Springer, Cham (2018)
5. Polak-Sopinska, A., Wrobel-Lachowska, M., Wisniewski, Z., Jalmuzna, I.: Physical work intensity of in-plant milk run operator. Part I - guidelines for assessment. In: Karwowski, W., Trzcielinski, S., Mrugalska, B., Di Nicolantonio, M., Rossi, E. (eds.) *Advances in Manufacturing, Production Management and Process Control*, AHFE 2018. *Advances in Intelligent Systems and Computing*, vol. 793, pp. 66–76. Springer, Cham (2019)
6. Polak-Sopinska, A., Maczewska, A., Kalinowska, P.: Assessment of the usefulness of software applications for estimating human energy expenditure in workplace organization. *The Malopolska School of Economics in Tarnów Research Papers Collection*, vol. 40, no. 4, pp. 63–78 (2018)
7. Barteveyan, L.: *Industry 4.0 – Summary report* (2015)
8. Barreto, L., Amaral, A., Pereira, T.: Industry 4.0 implications in logistics: an overview. *Procedia Manuf.* **13**, 1245–1252 (2017)
9. Hermann, M., Pentek, T., Otto, B.: Design principles for Industrie 4.0 scenarios. In: *2016 49th Hawaii International Conference on System Sciences (HICSS)*, pp. 3928–3937. IEEE, Koloa (2016)
10. Galińska, B.: Logistics megatrends and their influence on supply chains, business logistics in modern management. In: *Proceedings of the 18th International Scientific Conference, Faculty of Economics in Osijek*, pp. 583–601. Osijek (2018)
11. Bauernhansl, T., ten Hompel, M., Vogel-Heuser, B.: *Industrie 4.0 in Produktion, Automatisierung und Logistik: Anwendung Technologien Migration*. Springer, Wiesbaden (2014)
12. Bielecki, M., Galińska, B.: Total logistics management concept and principles in manufacturing enterprise. In: *Proceedings of International Scientific Conference Business Logistic in Modern Management Conference*, pp. 93–107. Osijek (2017)
13. Botthof, A., Hartmann, E.A. (eds.): *Zukunft der Arbeit in Industrie 4.0*. Springer (2015)
14. Wrobel-Lachowska, M., Polak-Sopinska, A., Wisniewski, Z.: Challenges for logistics education in Industry 4.0. In: Nazir, S., Teperi, A.M., Polak-Sopińska, A. (eds.) *Advances in Human Factors in Training, Education, and Learning Sciences*, AHFE 2018. *Advances in Intelligent Systems and Computing*, vol. 785, pp. 329–336. Springer, Cham (2019)
15. Polak-Sopinska, A.: Physical work intensity of in-plant milk run operator. Part II – case study. In: Karwowski, W., Trzcielinski, S., Mrugalska, B., Di Nicolantonio, M., Rossi, E. (eds.) *Advances in Manufacturing, Production Management and Process Control*, AHFE 2018. *Advances in Intelligent Systems and Computing*, vol. 793, pp. 77–89. Springer, Cham (2019)

16. Rohrbach, T. (ed.): German Industry 4.0 Index. Study, Staufen AG and Staufen Digital Workx (2016)
17. Müller, J.M., Buliga, O., Voigt, K.-I.: Fortune favors the prepared: how SMEs approach business model innovations in Industry 4.0. *Technol. Forecast. Soc. Change* **132**, 2–17 (2018)
18. Szaśniadek, M., Basł, J.: Świadomość i poziom wdrożenia koncepcji Przemysł 4.0 w wybranych polskich i czeskich przedsiębiorstwach. In: Knosala, R. (ed.) *Innowacje w zarządzaniu i inżynierii produkcji*, pp. 189–198. Oficyna Wydawnicza Polskiego Towarzystwa Zarządzania Produkcją, Opole (2018)
19. Slusarczyk, B.: Industry 4.0 - are we ready? *Polish J. Manag. Stud.* **17**(1), 232–248 (2018)
20. Klitou, D., Conrads, J., Rasmussen, M.: Poland: Initiative for Polish Industry 4.0 - The Future Industry Platform. Report, European Commission (2018)
21. Raport o stanie sektora MSP w Polsce (2018). <https://www.parp.gov.pl>
22. Demography report (2010). <https://publications.europa.eu/>
23. World Population Prospects (2017). Revision. <https://esa.un.org/>
24. Takala, E.P., et al.: Systematic evaluation of observational methods assessing biomechanical exposures at work. *Scand. J. Work. Environ. Heal.* **36**(1), 3–24 (2010)
25. Hand Activity TLV® 1 ACGIH® TLV® for Hand Activity. <http://personal.health.usf.edu/>
26. TLVs and BEIs: Threshold Limit Values for Chemical Substances and Physical Agents and Biological Exposure Indices. <https://www.nsc.org>
27. Assessment of repetitive tasks of the upper limbs (the ART tool). <http://www.hse.gov.uk/>
28. Schaub, K., Caragnano, G., Britzke, B., Bruder, R.: The European assembly worksheet. *Theor. Issues Ergon. Sci.* **14**(6), 616–639 (2013)
29. Keyserling, W.M., Brouwer, M., Silverstein, B.A.: A checklist for evaluating ergonomic risk factors resulting from awkward postures of the legs, trunk and neck. *Int. J. Ind. Ergon.* **9**, 283–301 (1992)
30. Assessment of manual handling tasks based on key indicators. <https://www.baua.de/>
31. Key indicator method for assessing physical workload during manual handling operations. <https://www.baua.de/>
32. Handlungsanleitung zur Beurteilung der Arbeitsbedingungen beim Ziehen und Schieben von Lasten. <https://lasi-info.com/>
33. Assessment of pulling and pushing based on key indicators. <https://www.baua.de/>
34. Manual handling assessment charts (the MAC tool). <http://www.hse.gov.uk/>
35. ManTRA. <https://www.worksafe.qld.gov.au/>
36. Further risk assessment methods for Hazardous Manual Tasks. <http://ergonomics.uq.edu.au/download/mantra2.pdf>
37. Manual Handling of Loads Lifting, Holding, Carrying: Guideline Manual Handling Assessment Tables (MAT). <https://www.arbeitsinspektion.gv.at/>
38. Code of Practice for Manual Handling. <https://worksafe.govt.nz/>
39. Waters, T.R., Putz-Anderson, V., Garg, A., Fine, L.J.: Revised NIOSH equation for the design and evaluation of manual lifting tasks. *Ergonomics* **36**(7), 749–776 (1993)
40. Occhipinti, E.: OCRA: a concise index for the assessment of exposure to repetitive movements of the upper limbs. *Ergonomics* **41**(9), 1290–1311 (1998)
41. Karhu, O., Kansil, P., Kuorinka, I.: Correcting working postures in industry: a practical method for analysis. *Appl. Ergon.* **8**(4), 199–201 (1977)
42. Buchholz, B., Paquet, V., Punnett, L., Lee, D., Moir, S.: PATH: a work sampling-based approach to ergonomic job analysis for construction and other non-repetitive work. *Appl. Ergon.* **27**(3), 177–187 (1996)
43. Kemmlert, K.: A method assigned for the identification of ergonomic hazards — PLIBEL. *Appl. Ergon.* **26**(3), 199–211 (1995)

44. Li, G., Buckle, P.: A practical method for the assessment of work-related musculoskeletal risks – Quick Exposure Check (QEC). In: *Proceeding of the Human Factors and Ergonomics Society Annual Meeting*, vol. 42, no. 19, pp. 1351–1355 (1998)
45. Risk Assessment for Pushing and Pulling - RAPP tool. <http://www.hse.gov.uk>
46. Hignett, S., McAtamney, L.: Rapid Entire Body Assessment (REBA). *Appl. Ergon.* **31**(2), 201–205 (2000)
47. McAtamney, L., Corlett, E.N.: RULA: a survey method for the investigation of world-related upper limb disorders. *Appl. Ergon.* **24**(2), 91–99 (1993)
48. Garg, A., Moore, J.S.: The strain index: a proposed method to analyze jobs for risk of distal upper extremity disorders. *Am. Ind. Hyg. Assoc. J.* **56**(May), 443–458 (1995)
49. Garg, A., Moore, J.S., Kapellusch, J.: The strain index to analyze jobs for risk of distal upper extremity disorders: model validation. In: *2007 IEEE International Conference on Industrial Engineering and Engineering Management*, pp. 497–499. IEEE, Singapore (2007)
50. Snook, S.H., Ciriello, V.M.: The design of manual handling tasks: revised tables of maximum acceptable weights and forces. *Ergonomics* **34**(9), 1197–1213 (1991)
51. Asadi, N.: A comparative assessment of manual load lifting using NIOSH equation and WISHA index methods in industrial workers of Shiraz City. *J. Heal. Sci. Surveill. Syst.* **3**(1), 1–5 (2015)
52. A Step-by-Step Guide to the WISHA Lifting Calculator. <https://ergo-plus.com/wisha-lifting-calculator-guide/>
53. IFM Chemnitz: Dynamicus Tools. <https://www.ifm-chemnitz.de/en/products/human-machine-interaction/dynamicus-tools/>
54. 3D Design Engineering Software - Dassault Systèmes®. <https://www.3ds.com>
55. ema - Human Simulation, 3D Production Planning and Virtual Ergonomics with ema Software. https://www.imk-ema.com/ema_homepage.html
56. Fritzsche, L., Jendrusch, R., Leidholdt, W., Bauer, S., Jäckel, T., Pirger, A.: Introducing ema (Editor for Manual Work Activities) – a new tool for enhancing accuracy and efficiency of human simulations in digital production planning. In: Duffy, V.G. (ed.) *Digital Uman Modeling, ICDHM 2011*. LNCS, vol. 6777, pp. 272–281. Springer, Heidelberg (2011)
57. Jack. <https://www.plm.automation.siemens.com>
58. Chiang, J., Stephens, A., Potvin, J.: Retooling Jack’s static strength prediction tool. *SAE Tech. Pap. Ser. 1*, April (2016)
59. HS Group - Products Mobility - Comfort and safety in the green zone. <https://www.human-solutions.com>
60. Virtual and Augmented Environments and Realistic User Interactions To achieve Embedded Accessibility DesignS. <https://cordis.europa.eu/project/rcn/93725/en>
61. 3DSSPP Software Center for Ergonomics. <https://c4e.engin.umich.edu>
62. 3D Static Strength Prediction Program Version 7.0.0 User’s Manual. <https://c4e.engin.umich.edu/>
63. Polak-Sopinska, A.: Incorporating human factors in in-plant milk run system planning models. In: Ahram, T., Karwowski, W., Taiar, R. (eds.) *Human Systems Engineering and Design, IHSED 2018*. *Advances in Intelligent Systems and Computing*, vol. 876, pp. 160–166. Springer, Cham (2019)
64. Fišerová, S.: Methods of cognitive ergonomics in assessment of psychosocial risks in work systems. *Probl. Profesjologii* **1**, 181–197 (2013)



Resistance in the Change Process

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Abstract. In the article, research findings are reported that were made during the verification analysis of DBMCI dynamic models. The models were developed in the research project on the dynamics of organizational change implementation. The analysis was performed in the research laboratory SYDYN. Six organizations, household appliance manufacturers, with the headcount ranging from 350 to 1480 were studied.

The findings reveal the relationships between particular social phenomena (processes and subprocesses) and the dynamics of change implementation. Organizational change in time function was analyzed that took into account modeling factors. The findings are presented as models of dynamic responses of the implemented change in small groups of employees.

Keywords: System dynamics · Change implementation · Resistance to change

1 Introduction

The primary aim of the study was to identify the basic types of object (social group, process) responses to the input signal of the type: enforced change. This was accomplished by way of analysis of processes that accompany organizational change effort, establishing dynamic properties of these processes, and verifying the effectiveness of the proposed method of the realization of change. Based on the comparison of the state of affairs in the studied organizations and on the identification of worker attitudes to the implementations, analytical categories were established to describe the dynamics of change with respect to its social aspects. Application of these analytical categories also made it possible to reconstruct the examined phenomena and to model them. It also enabled the identification of factors that influence the progression of change from the vantage point of its social dimension, and prediction of such progression through the analysis of occurrence, strength (intensity), and dynamics of individual phenomena. This allowed the persons coordinating the change effort to monitor employee attitudes on an ongoing basis, to anticipate their reaction to the pending change, and to take appropriate corrective actions depending on the current state.

2 Determinants and Methodology of Change Implementation

The initiation and implementation of organizational change (the need for it, its range, its rate) are determined by internal and external factors [1, p. 60]. Internal factors usually elicit an evolutionary character of change. These realizations tend to have the quality of being welcome and anticipated, planned and accompanied by expectations of enhanced effectiveness in an area of the organization's activity. Hence, acceptance of this type of modification is common. Reportedly, a majority of change programs triggered by internal factors are successful and unobstructed by resistance or anxiety of the interested members of the organization. As if the staff were convinced that change is a genuine opportunity for the sustainability of the organization. Grouard and Meston [2, p. 21] do not support this view and think that the development of internally motivated change may vary greatly and that it is impracticable to pass a priori judgments on its favorable outcome based solely on the origin of the factors that prompt the change (internal, external).

Change triggered by external causes usually evokes coerced circumstances [3]. It entails resistance, conflict, and strong emotions. There is an accompanying lack of understanding and approbation. The nature of such change is revolutionary, and a majority of efforts end in failure for exactly these reasons: misconception and strong opposition.

The nature of innovation processes is much the same [4]. Organizations perceive a changing environment as a state of uncertainty. Once the critical safety threshold is exceeded, a need for innovation arises. These effects usually come down to a reaction to signals incoming from the organization's external environment and trigger a response in the form of innovation programs which generate resistance and are counteracted by the members of the organization in an attempt to preserve the status quo. Innovation actions set in motion by request of employees with no undertones of conflict at source of the innovation and no coercion fueled by uncertainty tend to be less dramatic and more evolutionary in nature.

The landscape of change initiation tends to be even more complex. When antagonistic attitudes, tension, and degradation of internal processes necessitate the implementation of change to staunch further deterioration of the organization's performance, then, despite being internally motivated, change is resisted. This is brought about exactly by the very deterioration of processes which has reached such a level that decision-makers have little choice but to take action. Such actions tend to be weighed against those who have provoked the innovation. Therefore, not all kinds of innovation and change that stem from within the organization proceed smoothly, unhindered by waves of resistance.

One of the most challenging tasks in the process of change is to get people on board with it. When the meaning of objectives is defined, it is by reference to value systems in order to give proper weight to particular elements. This is when needs, emotions, beliefs, values, paradigms of thinking, and goals are formed and correlated to influence the act and the subject of analysis in such a way that a framework of reference is built at once.

It is important to persuade people to change their perceptions, which involves altering some aspects of deep perception systems: either how they are used (superficial persuasion) or what they are (deeper persuasion). Values are the shared principles people live by; that, which governs proper and improper conduct and dictates what is right and what is wrong.

Of course, there are many persuasion systems, however, whenever a person resists change, all that needs to be done is to help her/him see it in a new light, which alters the structure of perception.

There are many conceptualizations of the process of change management (including change implementation). They represent different currents of thought and have been developed by theoreticians and practitioners of management. They vary in their methodologies for change implementation. The main trends in approaches to change management can be summarized in the currents of thought presented in Table 1.

Table 1. Predominant approaches to change management

Thought currents, concepts	Authors
Adaptation and evaluation	Child–1972, Miller, Friesen–1980
BPC (<i>business process change</i>)	Kaplan, Murdoch–1991, Davenport–1993, Hammer, Champy–1993
Chaos theory and complexity theory	Nonaka–1988, Smith, Gemmil–1991, Stacey–1992, Gaustello–1995, Kiel, Elliot–1995
Perpetual learning, self-organization, learning organizations	Hedberg–1976, Argyris, Shon–1978, Senge–1990, Fortune, Peters–1995
Creativity and innovation management	Kirton–1980, Flood, Jackson–1991, Henry–1991, Morgan–1993
Organizational culture and identity	Schein–1983, Sathe–1985, Hofstede–1991
Ethics and values	Jacobs–1992, Salomons–1992, Hall–1994, Simons–1995
IT approach	Bemelmans–1984, Tozer–1985, Martin–1989
Popularization approaches	Peters, Waterman–1982, Handy–1989, Kanter–1989
Organizational development	French, Bell–1984, Cummings, Huse–1989
Ecology	Hannah, Freeman–1977, Rundall, McClain–1982
Quality approach	Crosby–1979, Deming–1982, Taguchi–1986, Juran–1988
Phenomenological approach	Zucker–1977, Ranson–1980
Change framework for change	Lewin–1951, Nadler–1988, Meyer–1993, Clark–1997
Philosophical paradigm	Nisbet–1970, Burrell, Morgan–1979
Social theory	McKinney, Tiryakin–1970, Zald, Berger–1978
Systems approach	Checkland–1972, Churchman–1979, Ackoff–1981, Mason, Mitroff–1981
Systems engineering, operational research	Hall–1962, Jenkins–1969, Daellenbach–1983
System dynamics	Forrester–1971, Wolstenholme–1990, Sterman–1994
Open systems	Miller, Rice–1967, Scott–1987, Mullins–1989
Organizational cybernetics	Beer–1985, Robb–1985, Espejo–1987

Based on: [5–9]

The models provide different names for particular stages of the change process yet it all comes down to the following three stages [10, p. 56] which can be termed generically: disengagement from the past, transition from the current state, organizational empowerment for future actions. The basic phases in a change cycle are preparation, implementation, and evaluation. Nevertheless, it should be acknowledged that advancements in management systems, technologies, and management science itself doubtless result in considerable and meaningful elaboration and particularization of the change cycle phases. Classical and novel approaches to change management are based on a set of psychological and sociological theories. Familiarity with the underlying principles of the various methods applied to the change process may have a positive influence on the design of implementation processes and tools.

Participation of people who stimulate, encourage and communicate how the change process proceeds and the impact they have are crucially important. There are reasons to entrust experts whom the people involved in the change hold in high esteem with these roles. This group also includes those who directly participate in the change efforts, make decisions on whether the implementation strategy should be modified or the original one enforced [11]. This tallies with the idea that emerged out of the analysis of the dynamics of change implementation [12] which was the subject of verification and some elements of which are discussed in this article. The idea rests on the engagement of suitable teams of people whose task it is to develop and correct decisions controlling the system. Their role also requires them to engineer such control signals indicating the state of the implementation that they could set off specific dynamic responses [13]. These actions are supposed to eliminate the impact of natural, detrimental changes and responses to the implementation (for example resistance) since these reactions tend to reduce the efficacy and effectiveness of the efforts of the change management team because they are meant (by the workers) to preserve the state of the organization as it was prior to the introduction of change.

3 The Emergence of Resistance in the Process of Change

Actions to expedite the achievement of an intended result affecting an element of the organization elicit opposition. The stronger the pressure to accomplish a goal, the stronger the reaction. This phenomenon has been known in the management theory as Chatelier's principle (or the Equilibrium Law), in physics as Newton's 3rd law of motion, and negative (balancing) feedback in the systems approach [14, 15].

At the onset of the implementation, questions arise usually motivated by anxiety and concerns related to the process and the aim of the change. As they make inquiries, workers question the intentions of their interlocutors: Are their answers full and honest? Are the agents of change acting in good faith? Do they know what is going to happen? Most often than not, people will form their own opinions on how the situation is going to or should unfold. The exchange of questions and answers is only to provide arguments in support of one's own appraisal of the situation. The truth of certain judgments is presumed, and efforts are made to lend them credence.

There are also questions that seek assurances that support will be provided, and the rules of *fair play* will be abided by. When one cannot control the course of events, it is

reassuring to have a sense of fair treatment. Organizations that appreciate the respect they command and demonstrate fair-minded approach to the process of change are able to carry through much greater change and with much better results.

The substance of worker inquires, and concerns is a relevant source of information about the state of the organization at the onset of the implementation. Organizations would be well-advised to consider it carefully as this can be useful knowledge.

The unease in the face of the imminent change manifested as anticipation of negative repercussions for workers is also a negative occurrence. Workers, fearful of the complications the change implies (especially, if they have personally experienced negative consequences, e.g. they have been laid off, assigned to a different position, relegated), prove highly active in precluding such disadvantageous effects by restlessly seeking better employment opportunities. Performance at work is inferior due to the fact that they consider their current job temporary. It tends to improve once they get a sense a generalized impending threat.

Keeping a low profile is another manifestation of worker negative attitude toward change. Workers perform work in such a way that they could be inconspicuous. They obey orders, complete tasks but only with a view to promoting their narrow personal interests. When feeling threatened, they exhibit particular professional activity so as to avoid being laid off. During the implementation, 'the hidiers' do not openly resist the change and give in to the process only to sabotage it. Their opinions always agree with the general sentiments; they never attract attention. This is a particularly dangerous attitude because it lulls the change management team into a sense of false security in the face of a critical threat to the change efforts. Implementation failure may catch them off guard.

Apparently, the most desirable attitude is demonstrated by workers who are excited and cooperative about the change. Needless to say, true motives for their enthusiasm could be at issue and therefore, it would be well-advised to consider whether their positive attitude really augurs well for the implementation.

There are many taxonomies of the sources of resistance to change [16–19]. A majority of them can be reduced to the categorization into overt/covert and immediate/deferred resistance [20]. Regardless of which classification is applied, resistance and its magnitude always depend on the specific circumstances of change and the stage it is at [21].

Ambiguity concerning the need for change is frequently a result of change agents' negligence through failing to inform workers about the reasons for change, its goals and principles, which contributes to the escalation of resistance. No less important is the potential (partial) loss of privilege warranted by the exigencies of change but also awareness of the weaknesses of the proposed change [22].

Analytical approach to the identification of resistance to change may arm change management teams with tools to grapple with resistance and its negative effects. In the extensive body of research on change management there are references to the same groups of tools which rely on:

- effective communication,
- solving problems collectively,
- boosting creativity,

- creating better working conditions,
- demonstrating management commitment to developing and implementing change,
- revising the incentive system,
- refining the ways of communication,
- facilitating adaptation to new conditions,
- manipulation,
- coercion.

The said categories of tools allow change managers to establish solid foundations for the implementation of change and not only to overcome resistance and mitigate its effects but also to eliminate it at its source.

Carrying through change implementation requires method and determination in surmounting stumbling blocks which appear whenever modification of the performance of a subsystem is attempted in a mould-breaking way.

4 Identification of the Dynamics of Change – Identification of Resistance

The point of the study was, among others, to identify responses to change in the organization. The analysis of the relationships of the characteristics of the subsystem dynamics to the characteristics of the change itself, model of involvement, variability in organizational performance, management practices, was affected through the identification of how responses to the implementation changed in time.

The change under implementation is characterized with respect to its nine traits. It is sudden in the sense that it is introduced without prior notice or making employees ready.

1. **conspicuity of change** – how possible it is to tell the difference between the situation prior to and after the implementation,
2. **magnitude of change** – the range of its impact in terms of both the number of workers and the number of processes it affects,
3. **durability of change** – the time in which the change is to abide,
4. **reversibility of change** – perceived possibility of returning to the situation prior to the implementation,
5. **general salience of change** – meaningfulness of the implementation for the entire organization's operation, and for the work of all its employees,
6. **particular salience of change** – meaningfulness of the implementation for individual employees,
7. **integrity of change** – the level of readiness of the particular aspects of the implementation at the time when it is proceeded with,
8. **novelty of change** – the degree of dissimilarity between this and all prior implementations,
9. **complexity of change** – interpreted as the number of modifications and actions required for its implementation.

At the core of the analyses referred to above is the concept of an organization as a system characterized by a dynamic response which can be controlled. To this end, one could draw upon the theory of dynamic systems and cybernetics. In this approach, it is important to identify the dynamic behavior of the object that is subjected to change. It was found that a process or a group of people affected by sudden change can be that object. It was also established that each of the objects could be described with sufficient approximation with one of the 16 types of dynamic objects provided that appropriate descriptors of such objects were selected to enable the identification of the type and kind of their dynamic response. By applying control theory techniques of object description and testing the models on a group of 727 subjects [12], it was possible to reduce it to such parameters as presented below.

The transfer function was used to describe the dynamic behavior of the objects. This approach facilitated analysis of dynamic processes as control theory provides a vast range of useful tools. The typical object that was subject to the implementation of change was described as a second-order inertial high sensitivity element with time delay. Its transform function is expressed with the formula (1).

$$G(s) = k \left(\frac{T_3 s + 1}{T_0^2 s^2 + 2\zeta T_0 s + 1} e^{-s\tau_0} \right) = kF(s)e^{-s\tau_0} \quad (1)$$

The results of the identification of the parameters of the objects that are subject to change implementation are represented as: k , T_3 , T_0 , ζ , τ_0 (See formula 1.) or, for special cases, as: k , T_1 , T_2 , T_3 , τ_0 (See formula 2.).

$$G(s) = k \left(\frac{T_3 s + 1}{(T_1 s + 1)(T_2 s + 1)} e^{-s\tau_0} \right) \quad (2)$$

Based on the collected data it was established that all analyzed cases of the objects could be represented with satisfactory precision with the transfer function (1). From the vantage point of change management and implementation, the most important issues for the progression of change processes are whether:

1. in the steady state, the system will have achieved the intended state (target),
2. the system reacts immediately once exposed to the input signal,
3. resistance occurs and how strong it is,
4. overshoot occurs, the system has difficulty stabilizing, and whether these oscillations can be controlled.

The above questions can be translated into questions about the dynamic parameters and the relationships that hold between them. The 'dynamic response' version of the questions concerning system behavior is as follows:

1. What is the value of gain k ?
2. What is the value of time constant τ_0 ?
3. What is the value of settling time T_3 ?
4. What is the value of damping ratio ζ ?

Clearly, the point is not to identify the relationship between specific values of these coefficients but rather to define the ranges of their values that determine specific characteristic behavior of the systems, in which case the analysis consists in identifying the realizable models of the systems (Table 2) that best match the actual dynamic behavior in response to change.

The realizable types of dynamic responses are defined in terms of the basic parameters used in the description of system dynamics. The ranges of coefficient values:

1. gain k :
 - a. $k < 1$ – the system is characterized by statism, which means that in its steady state it has not achieved the intended output level; in other words, the system is not capable of the target change.
 - b. $k = 1$ – the asymptote converges with the target level;
2. time constant τ_0 :
 - a. $\tau_0 = 0$ – delay does not occur in the system; not to be confused with resistance to change (inertia),
 - b. $\tau_0 > 0$ – delay equal to τ_0 occurs,
3. settling time T_3 :
 - a. $T_3 = 0$ – resistance does not occur;
 - b. $T_3 < 0$ – resistance to change occurs,
4. damping ratio ζ :
 - a. $0 < \zeta < 1$ – the system overshoots the final value and then oscillates around it, eventually converging;
 - b. $\zeta > 1$ – aperiodic system; there is no overshoot and the system asymptotes to the final value without oscillation.

Following the observations on the basis of which the dynamic responses of the objects were produced, the relationships between the presented factors were analyzed. For the purposes of statistical analysis, the presence or absence of certain dynamic characteristics was assumed based on the obtained values and on the application of the following principles:

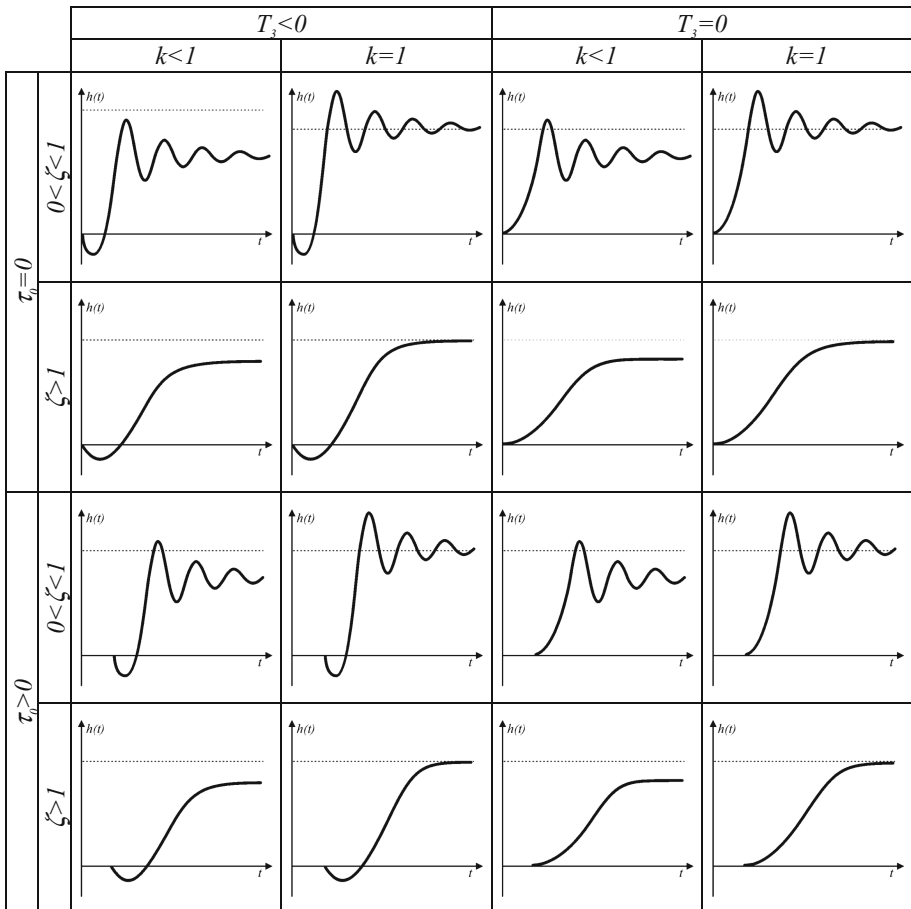
1. $k < 0.95$ – statism is present when the steady-state error is steadily smaller than the value of a specified margin.
2. $\tau_0 > 1/10$ of the highest value of time constant – delay is deemed to be real when its value computed in the model is greater than 10% of the time constant for the greatest inertia. This constant determines the character of the object. Because the absolute values of time constant differ by situation, delay is as a rule analyzed against the values characterizing the object in order to avoid arbitrary determination of a delay boundary value, which could lead to inaccurate interpretations when, for example, rise time for one object will be 200 h to the delay of 0.2 h, whereas for another object it will be 2 h to the delay of $\tau_0 = 0.2$ h.
3. $T_3 < -0.1$ – it was established experimentally that for $T_3 \in \langle -0.1, 0 \rangle$ resistance actually does not occur. Only for values lower than constant, a decrease in effectiveness may be related to system resistance. Unlike for delay and its reference values, absolute boundary values were used because the nature of the influence of

T_3 is such that it affects the most the value of the outcome and not its displacement in time. Therefore, the dependence of T_3 effects on other time constants is lesser than it is for τ_0 .

4. $\zeta < 0.97$ – this boundary value was set because in the analyzed cases, only for ζ values smaller than the specified can oscillations or at least a maximum value be observed (when there is no oscillation, there is no overshoot).

The established boundary conditions enable standardization of dynamic parameters and reduction of the models to one of the 16 types (Table 2).

Table 2. Types of responses to stimuli (input signals)



Source: [12]

5 Summary

Only those variants of the systems were presented that are practicable for organizations such as the enterprise. Therefore, systems with undamped oscillations, large gains, and other traits that in spite of having mathematical sense would be useless for organizations in their practice.

The most important issue is to know whether resistance is going to occur, whether a goal stands a chance of accomplishment, whether the system's response is going to be delayed, etc. Parameters referring to the details of a particular progression can be established by in-depth analysis of individual scenarios, but they are not essential to determine the type of response.

Further analysis will concentrate on exploration of relationships between the identified dynamic parameters and other parameters used to describe change implementation processes in specific conditions. The point will be to determine potential correlations and potential impact of certain parameters characterizing the environment of the implementation and the properties of the change itself on dynamic quality of the object participating in the implementation.

References

1. Krupa, K.: Teoria zmian organizacyjnych przedsiębiorstw ery informacji (wybrane aspekty i narzędzia). Wydawnictwo Uniwersytetu Rzeszowskiego, Rzeszow (2006)
2. Grouard, B., Meston, F.: Kierowanie zmianami w przedsiębiorstwie. Poltext, Warszawa (1997)
3. Cameron, K.S., Quinn, R.E.: Kultura organizacyjna–diagnoza i zmiana. Oficyna Ekonomiczna, Krakow (2003)
4. Francik, A.: Sterowanie procesami innowacyjnymi w organizacji. Wydawnictwo Akademii Ekonomicznej, Krakow (2003)
5. Baugier, J., Vuillod, S.: Strategie zmian w przedsiębiorstwie. Nowoczesna metoda. Poltext, Warszawa (1993)
6. Clarke, L.: Zarządzanie zmianą. Gebethner i S-ka, Warszawa (1997)
7. Maslyk-Musiał, E.: Zarządzanie zmianami – kluczowe kompetencje w firmie. Współczesne zarządzanie **4**, 7–24 (2002)
8. Mikołajczyk, Z.: Zarządzanie procesem zmian w organizacjach. Gornoslaska Wyższa Szkoła Handlowa, Katowice (2003)
9. Stickland, F.: The Dynamics of Change: Insights into Organisational Transition from the Natural World. Routledge, New York (2002)
10. Maslyk-Musiał, E.: Organizacje w ruchu: strategie zarządzania zmianami. Oficyna Ekonomiczna, Krakow (2003)
11. Bennis, W.G.: Organisation Development: Its Nature, Origins, and Prospects. Addison-Wesley, New York (1969)
12. Wisniewski, Z.: Wdrażanie zmian w organizacji. Ujęcie dynamiczne. Wydawnictwo Politechniki Łódzkiej, Łodz (2010)
13. Matejun, M., Mikolas, Z.: Small business life cycle: statics and dynamics (S&D) model. Eng. Manag. Prod. Serv. **9**, 48–58 (2017)
14. Wisniewski, Z., Wisniewska, M., Polak-Sopinska, A.: Dynamics of resistance in the change process. Adv. Intell. Syst. Comput. **792**, 77–86 (2019)

15. Polak-Sopinska, A.: Incorporating human factors in in-plant milk run system planning models. In: Ahram, T., Karwowski, W., Taiar, R. (eds.) *Human Systems Engineering and Design, IHSED 2018. Advances in Intelligent Systems and Computing*, vol. 876. Springer, Cham (2019)
16. Griffin, R.W.: *Podstawy zarządzania organizacjami*. PWN, Warszawa (1996)
17. Maslyk-Musial, E.: *Zarządzanie zmianami w firmie*. Centrum Informacji Menedzera, Warszawa (1996)
18. Stoner, J.A.F., Wankel, C.: *Kierowanie*. PWE, Warszawa (1992)
19. Tichy, N.M.: *Managing Strategic Change: Technical, Political, and Cultural Dynamics*. Wiley, New York (1983)
20. Jedrych, E.: *Dyfuzja innowacji personalnych w organizacjach gospodarczych*. Wydawnictwo Politechniki Lodzkiej, Lodz (2008)
21. Wisniewska, M., Wisniewski, Z.: The relationship between knowledge security and the propagation of innovation. *Adv. Intell. Syst. Comput.* **783**, 176–184 (2019)
22. Wisniewski, Z., Polak-Sopinska, A., Wisniewska, M., Sopinski, P.: Implementation of ergonomic changes. *Procedia Manuf.* **3**, 4740–4747 (2015)



The Role of Leadership in Organizations Managed in Conformity with ISO 9001 Quality Management System Standard

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Abstract. The role of top management in organizations managed in conformity with ISO 9001 Quality Management System (QMS) standard has been rising in importance. In view of this standard, leadership should play a fundamental role with regard to processes related to planning, support, operation, performance evaluation, and improvement. The aim of the article was to determine the effect of the ISO 9001 - Quality Management System standard on the responsibilities of top management with respect to the resources managed and processes carried out in the organization. Materials and methods: The study involved 30 enterprises in the food industry. The research participants were divided into two groups of equal size. One group included enterprises which have operated with a quality management system for at least seven years, whereas the other included organizations which have never been managed in conformity with the QMS standard. CAPI and PAPI techniques were used. For both of these quantitative methods an auctorial interview questionnaire was employed. Results: Indicators for all of the studied top management responsibilities (to the exclusion of demonstrating commitment to customer focus where both groups achieved the same results) bespeaking the commitment of top management to resource management and process completion were higher for the companies which had implemented an ISO 9001 QMS at least seven years prior to the study.

Keywords: Management · Leadership · Quality management system · Responsibility · Resources · Processes

1 Introduction

ISO 9001 Quality Management System is an optional quality management standard for organizations regardless of any considerations such as e.g. their size, type of operations or their location. Even though its implementation is not mandated by law, it has been largely favored by organizations, especially in the European countries, which arises from the fact that customers and stakeholders base their decision concerning cooperation with a company on whether it operates in conformity with the requirements of the ISO 9001 standard. On that account, it becomes critical that top management be committed to process and resources management. The ISO 9000 family of standards promote the adoption of the process approach in planning as well as implementing and

improving effectiveness of a quality management system to achieve the greatest satisfaction of the interested parties [13].

The article is concerned with the role of leadership in organizations managed in conformity with the ISO 9001 Quality Management System standard. However, the study presented in the article included organizations operating in conformity with the said standard as well as organizations unfamiliar with the requirements of the norm as a standard for organizational management. Principally, the study sought to answer the following question: What effect does an ISO 9001 Quality Management System have on the responsibilities of top management with respect to the processes and resources managed in the organization? To this aim, literature, normative regulations, survey and direct observation studies were carried out.

2 The Subject Matter of Leadership as Per Generic and ISO 9001 Quality Management System Requirements

Leadership and its role in the organization are very difficult to define. Plurality of definitions and a lack of a commonly accepted one testify to that claim [4]. The special role of leadership in contemporary management flows from the characteristics, functions, and its tasks. Leadership sets the strategic direction, builds teams, and inspires others by word and by example [1]. Leadership is also the skill to mobilize employees to strive for common goals and overcome obstacles but above all, to implement changes and build an open attitude to new challenges. Top management is responsible for ensuring effective implementation of an organizational strategy, nevertheless, for organizations to be successful there must be people who cooperate with the management [2]. The essence of strategic leadership consists in: the skill to effectively manage company operations including the skill to respond to the dynamics of resistance in the process of change, creating value and sustaining high effectiveness by taking fair, bold, and pragmatic decisions [5, 15]. Worth adding to the already mentioned is the creative ability defined as a process the completion of which is related to specific skills and attitudes. It is through these skills and attitudes that senior level managers create valuable and new conditions [9]. However, developing and writing down the core values alone will not suffice. If an organization wishes to introduce major changes in the functioning of the organization, it needs to implement value based management and model formation of attitudes to change [14], which requires time and systematic effort not unlike during the implementation of Total Quality Management [3]. Another contemporaneously very meaningful element which should be taken into account by top management in its actions is corporate social responsibility. It impacts on the reduction of failings in organizational activity and leads to a renewal of ethics, as it were, in the organization [9].

The concept of leadership has been framed according to many dimensions including:

- the time span a given phenomenon is present in the literature (indicating how the understanding of the concept has been changing over the years),

- the focusing dimension (leadership as the foundation of the functioning of the organization; the following types of leadership are distinguished with this approach: classical, transactional, organic, and visionary),
- a source of group members engagement,
- a vision and group members' reliance on it.

A current model of quality management system according to ISO 9001:2015 presented in Fig. 1 has leadership in the center of all activities of the organization. It assumes top management engagement in processes related to planning, support, operation, performance evaluation, and improvement.

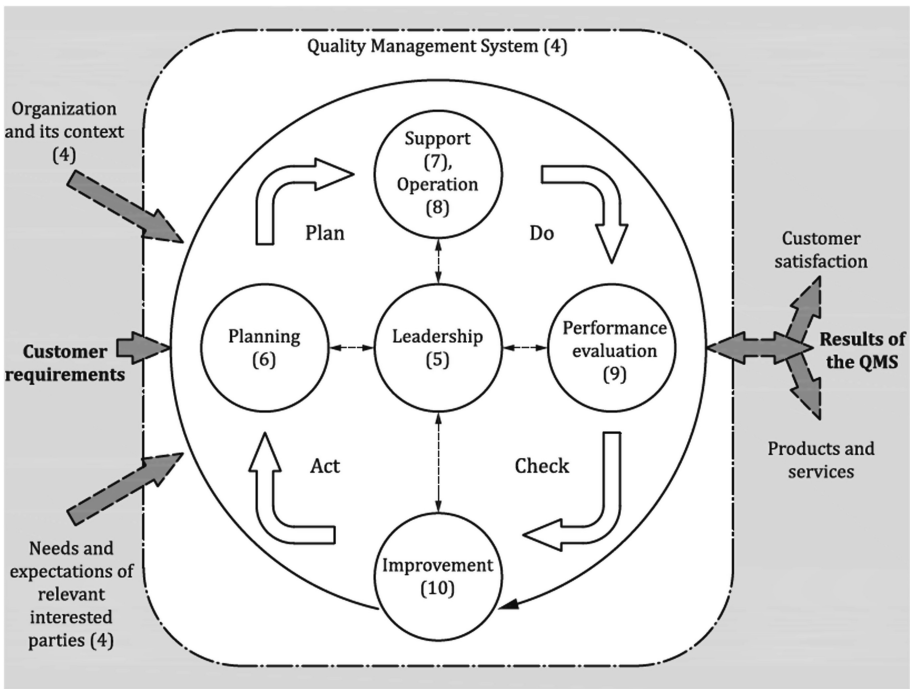


Fig. 1. Model of ISO 9001:2015 Quality Management System [8]

Differently was the role of leadership in a model of quality management system conceived of in the previous, 2008 version of ISO 9001 (Fig. 2). “Leadership” was not presented as the focal point of process management in the organization but rather as one of the elements of the PDCA cycle and at the same time was one of the clauses - Management responsibility. The revision of the ISO 9001 model for quality management systems and the figuring in of a greater role of leadership confirms that this subject matter has been growing in importance in organizational management.

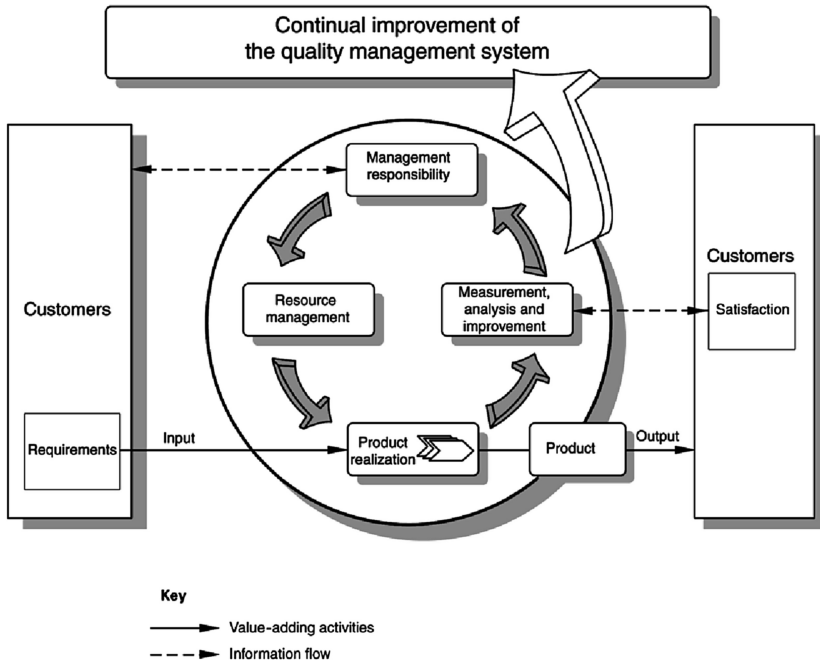


Fig. 2. Model of ISO 9001:2008 Quality Management System [7]

ISO 9000:2015, which is a terminological reference for ISO 9001 QMS, specifies and explains seven principles of quality management:

- customer focus,
- **leadership**,
- engagement of people,
- process approach,
- improvement,
- evidence-based decision-making,
- relationship management.

Each of the principles is elaborated on in the standard based on the following four aspects: statement, rationale, key benefits, and possible actions entailed by the application of each principle. With respect to the Leadership principle, ISO 9001 has it that ‘Leaders at all levels establish unity of purpose and direction and create conditions in which people are engaged in achieving the organization’s quality objectives.’ The rationale for it being that the establishment of the unity of purpose and direction enable an organization to align its strategies, policies, processes and resources to achieve its objectives.

Some of the potential key benefits of the principle application are as follows:

- increased effectiveness and efficiency in meeting the organization’s quality objectives,
- better coordination of the organization’s processes,
- improved communication between levels and functions in the organization,

- development and improvement of the capability of the organization and its people to deliver desired results.

Possible actions to bring the potential key benefits include:

- communicating the vision, mission, strategy, policies, and processes in the entire organization,
- creating and sustaining shared values, fairness, and models of ethical conduct at all levels in the organization,
- establish a culture of trust and integrity,
- encouraging an organization-wide commitment to quality;
- ensuring that leaders at all levels set a positive example for all people in the organization,
- providing people with the required resources, training, and authority to act with accountability,
- inspiring, encouraging, and recognizing the contribution of people.

The fifth clause in ISO 9001:2015 is titled ‘Leadership’. Presented in it are key requirements for top management in the organization grouped into: (1) leadership and commitment, (2) policy, and (3) organizational roles, responsibilities, and authorities. Considering the requirements related to ‘Leadership’ specified in the standard, one should mention the following:

- ensuring that the quality policy objectives are established,
- promoting process approach and risk-based thinking,
- ensuring availability of resources,
- promoting continual improvement,
- demonstrating leadership and commitment with respect to customer focus,
- ensuring that responsibilities and authorities for relevant roles are assigned, communicated, and understood in the organization.

The selection of the six requirements related to leadership referred to above out of the a dozen or so specified in the standard has been determined in the context of the foregoing study by the level of their generality which makes them suitable to be applied to the two groups of the organizations participating in the study.

3 Research Methods

The study was conducted in the third quarter of 2018. Having completed a review of the literature and observations based on ISO 9001 QMS compliance audits performed in the authors’ audit practice, the following research question was formulated: ‘What is the effect of an ISO 9001 Quality Management System on the responsibilities of top management with respect to resources managed and processes carried out in the organization?’.

The subjects of the study were small and medium-size manufacturing companies in the sector of food industry operating in Poland. 30 purposively sampled enterprises were qualified for the study. The sampling was based on the following criteria:

- time of operation in the market (over 7 years),

- ISO 9001 Quality Management System certification status,
- commitment and positive attitude to participation in the study of the organization's top management.

Based on the said criteria, 15 enterprises with an ISO 9001 QMS implemented for at least seven years and 15 enterprises operating for at least seven years but without an implemented ISO 9001 QMS were selected. Considering the industry in which the study participants operated, it should be pointed out that it is mandatory for food manufacturers in the European Union to have implemented a HACCP (Hazard Analysis and Critical Control Points) system, which is fundamental for ensuring the safety of food. The system is not intended to resemble ISO systems nevertheless, it includes in its requirements the process approach to organizations' activities. Thus, all of the studied enterprises had an implemented HACCP system but only 50% of them had not implemented any other standard, whereas the other 50% had, apart from a HACCP system, implemented an ISO 9001 system¹.

Both quantitative and qualitative **methods** were employed in the study. The quantitative methods included CAPI (laptop-based interviews administered at the company's principal place of business) and PAPI (paper-based interview questionnaire).

Both of the quantitative methods employed in the study were based on an auctorial interview questionnaire. The questionnaire was comprised of two parts. The first part included questions related to general information about the organization such as the time in the business, the QMS, type of business operation, international cooperation, headcount, and the age of the top manager. The second part of the questionnaire, the analysis of which provided the basis for answering the formulated research question, was primarily concerned with questions about top management responsibilities with respect to the managed resource² and processes³. The questions were addressed to the highest-ranking, executive management in the organization however, some of the answers to the questions in the second part of the questionnaire were verified by interviews with middle management (managers and foremen), and low-level management (e.g. production workers and administrative staff). The qualitative methods used in the study were direct observation and desk research, the latter of which relied on an analysis of materials found in the organizations, documents, and websites.

4 Study Results, Analysis, Conclusions

Analyzing the data collected in the study with respect to the general information about the examined enterprises it has been found that:

- 80% of the subjects has operated in the business for 10 to 15 years, whereas 20% longer than 20 years;

¹ As regards implementation options, food industry organizations wishing to implement an ISO system should rather consider the implementation of the sector-specific international standard ISO 22000.

² Defined as human resources, physical resources, financial resources, knowledge resources.

³ Defined as sets of interrelated or interacting activities that use inputs to deliver intended results (ISO 9000:2015).

- 30% of the subjects represented the dairy industry, 30% - the baking industry, 20% - the fruit and vegetable processing industry, and 20% - the meat industry;
- 10% of the subjects supplied their products internationally;
- 70% of the subjects employed 20 to 100 employees, 20% - 101 to 150 employees, and 10% - 151 to 200 employees;
- for 80% of the subjects, the age of the highest-ranking manager (called by the respondents President, Owner or Director General) ranged from 45 to 50 years, whereas for 20% of the subjects, the age of the owner ranged from 35 to 40 years.

Figure 3 shows the results of the study with respect to top management responsibility to establish the organization’s resources and processes. It turns out for the subjects with an implemented ISO 9001 QMS, both in the context of the top management responsibility to establish resources as well as processes, indicators were much better. 100% of the subjects with an ISO 9001 QMS declared that processes had been established and 86% declared the organization’s resources to have been established. As for the subjects without an implemented system, the former indicator - related to processes, was lower by 67%, whereas the latter - related to resources, was 54%. For the subjects operating in conformity with the QMS standard, all leaders were able to list the processes which had been identified in the business process mapping and to locate the process card. Resources were slightly more difficult for the top management in the studied subjects to identify, which could originate from the fact that the requirements of the ISO 9001 standard are not as detailed in this regard as they are for processes. For the subjects that had not implemented the ISO 9001 standard the very interpretation of the term ‘process approach’ proved challenging, which may arise from the fact that the HACCP system used by this group of the enterprises does not seem to emphasize so strongly the role of processes in the management of the organization as does ISO 9001.

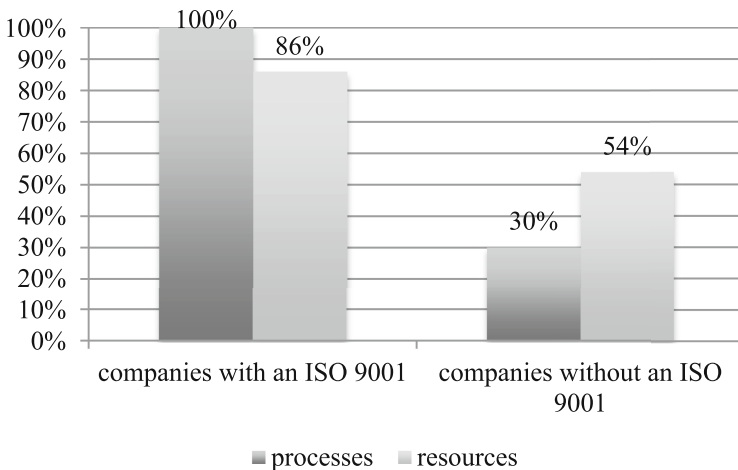


Fig. 3. Percentage share of the companies with established resources and processes

The results of the analysis of the key responsibilities of top management specified in the ISO 9001 standard concerning the general question of organizational management

and not directly related to the control of an implemented management system are shown in Fig. 4. Examined were six responsibilities of top management about which the leaders of the organizations as well as lower level employees (to verify responses) were asked. Whenever a discrepancy in responses occurred, the responsibility was validated by the authors by way of direct observation and further in-depth analysis. The results show that with respect to the analyzed responsibilities the companies which have implemented an ISO 9001 system come out better as far as fulfilling individual responsibilities by top managers is concerned. 80% of the leaders of the companies with an ISO 9001 system and 23% of the leaders of the companies without it carry out the responsibility to establish quality policy and objectives. The fact that the companies without a quality management system are not required by law to establish such policy and objectives may serve as a justification in this case. The second responsibility examined in the study is the responsibility to promote the process approach. For the companies with a QMS standard, this responsibility has been found to have the lowest ratings of all of the investigated responsibilities – in the mere 66% of the subjects their leaders fulfill this responsibility. For the companies not operating within the ISO 9001 environment, the value of this indicator was zero, which may prove that the HACCP system referred to above does not encourage or insufficiently clearly specifies requirements for the formation of the process approach in organizations. The third responsibility related to ensuring the availability of resources. In all of the organizations with an implemented ISO 9001 system (15 companies) this responsibility is carried out. Also for the enterprises which have not implemented a QMS, the indicator is high and equals 93%. Going back to the results presented in Fig. 3, it appears that it is more problematic for the leaders of the studied organizations to establish the resources than it is to provide them.

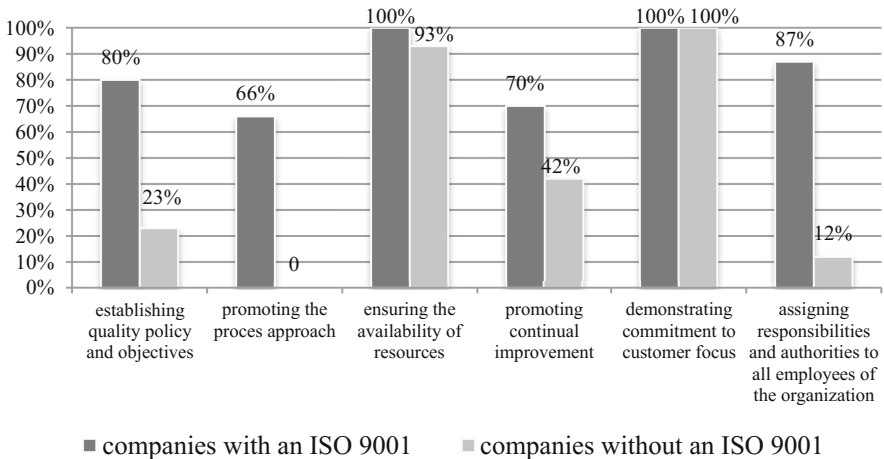


Fig. 4. The fulfillment of the key top management responsibilities as specified in the ISO 9001 QMS requirements

Another top management responsibility which was analyzed was the promotion of continual improvement. The lowest scores, second worst only to the promotion of the

process approach, were observed here. Top managers in 70% of the subjects with an ISO 9001 QMS system promote continual improvement, whereas such declaration was recorded for less than one half of the studied subjects without an ISO 9001 QMS - 42%. The process of continual improvement was interpreted in this case as, among others, introducing product and process innovations, carrying out corrective actions, and controlling nonconformities. The fifth studied responsibility of organizational leaders was demonstrating commitment to customer focus. In the case of this responsibility of top management, the only one among all of the studied ones, no difference has been observed between the enterprises which have and those which have not implemented an ISO 9001 system. All of the organizations participating in the study declare 100% commitment to customer focus. This is a very positive result which proves that top management realize the significance of customers and the power of their influence on the functioning of the organization. Assigning responsibilities and authorities for the organization's human resources is the last of the analyzed top management responsibilities. The variance between the organizations with an ISO 9001 system and those without one is very large and equals 75%. In 87% of the enterprises with an implemented QMS responsibilities and authorities have been assigned for all employees and documented in the so called job assignment form, whereas only 12% of the organizations where a QMS system is non-existent indicated that responsibilities and authorities had been assigned for members of the organization. Digressing from the requirements of the quality management system, it is worth underlining that the functioning of a formally established organizational structure and related to it - assigned for each organizational unit included in it - responsibilities and authorities with respect to tasks performed are the very foundation of management in any organization.

The conclusion to be drawn from the study and at once the answer to the formulated research question, finding which was the aim of the study, 'What is the effect of an ISO 9001 Quality Management System on the responsibilities of top management with respect to resources managed and processes carried out in the organization?' is unequivocal - it is strong especially with regard to the process approach. For all analyzed top management responsibilities (to the exclusion of demonstrating commitment to customer focus where the results are the same for both groups of the organizations) the indicators are higher for the companies which have had an implemented ISO 9001 Quality Management System for at least seven years. The smallest difference in the scores is 7% and has been observed for the responsibility to ensure the provision of resources, whereas the largest recorded difference is 75% and relates to assigning responsibilities and authorities for the organization's human resources. In the analysis of the results, no relation has been observed between individual top management responsibilities and the general information about the organizations.

5 Conclusion

Indisputably, the role of leadership in organizations regardless of whether they have implemented an international quality management system or not is prominent. Leaders of the organization establish its strategic direction and take key decisions that have a

strong effect on operation. Appropriate organizational culture and leadership are conducive to the acquisition of the best workers and facilitate their engagement in the effort to achieve common organizational goals [11]. An implemented ISO 9001 Quality Management System, as the study makes it apparent, aids in the management of the organization on the account of the requirements specified in the applicable standard. Furthermore, the available research reports [12] reveal that no significant obstacles to the implementation of a QMS have been found in the sector of small and medium-size enterprises.

The overarching value to be strived for in the process of the implementation of such a system is to emphasize the role of top management and make leaders cognizant of the fact that the level of a system's effectiveness will always be the same as the level of the leadership's commitment to the management of available resources and processes carried out in the organization.

References

1. Adair, J.: *Od bossa do lidera*. Wolters Kluwer Polska, Kraków, p. 91 (2008)
2. Amos, T.: Strategic leadership: key driver of strategy implementation. In: Louw, L., Venter, P. (eds.) *Strategic Management: Winning in the Southern African Workplace*. Oxford University Press, Cape Town (2006)
3. Devero, A.J.: Corporate values: stimulus for the bottom line. *Financ. Exec.* **19**(3), 22–23 (2003)
4. Guillot, W.M.: Strategic leadership: defining the challenge. *Air Space Power J.* Winter, 67 (2003)
5. Hitt, M.A., Ireland, R.D., Hoskisson, R.E.: *Strategic Management: Competitiveness and Globalization*. Thomson South-Western, Ohio, p. 376 (2005)
6. ISO 9000:2015 – Quality Management Systems – Fundamentals and vocabulary
7. ISO 9001:2008 – Quality Management Systems – Requirements
8. ISO 9001:2015 – Quality Management Systems – Requirements
9. Naouar, W.B.A.: Contribution of the management system and the institutional framework to the efficiency of values-based management. *J. Bus. Ethics* **135**, 787 (2016)
10. Parker, Ch., Stone, B.: *Developing Management Skills for Leadership*. Prentice Hall/Financial Times, Harlow (2001)
11. Urbanek, G.: *Kompetencje a wartość przedsiębiorstwa. Zasoby niematerialne w nowej gospodarce*. Wolters Kluwer Polska, Warszawa (2011)
12. Walaszcy, K.A.: Bariery we wdrażaniu systemu zarządzania jakością w przedsiębiorstwach sektora MSP w Polsce. *Przedsiębiorczość i zarządzanie XIX/9/III*, Lodz (2018)
13. Walaszcy, K.A.: Risk management of processes in the quality management system. *Annales Universitatis Mariae Curie-Skłodowska Lublin-Polonia Sectio H* **LII**, 1 (2018)
14. Wisniewski, Z., Polak-Sopinska, A., Rajkiewicz, M., Wisniewska, M., Sopinski, P.: Modelling formation of attitudes to change. In: Goossens, R. (ed.) *Advances in Social & Occupational Ergonomics. Advances in Intelligent Systems and Computing*, vol. 487. Springer, Cham (2017)
15. Wisniewski, Z., Wisniewska, M., Polak-Sopinska, A.: Dynamics of resistance in the change process. In: Goossens, R. (ed.) *Advances in Social and Occupational Ergonomics. AHFE 2018. Advances in Intelligent Systems and Computing*, vol. 792. Springer, Cham (2019)

Teamwork and Leadership Development



Mind Matters 2: Engage and Develop Teams

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Abstract. We report on Mind Matters - a game based learning solution for training and developing Leadership competences. The overall game model in Mind Matters is that players can use a mind steering device enabling them to temporarily ‘taking over’ game characters and steering their behaviors. By doing so, the player influences the dialogue between the in-game characters within the scene. Here we describe Module 2.

Keywords: Game based learning · Leadership skill development · Dilemma training

1 Introduction

Earlier, we reported on Mind Matters - a game based learning solution for training and developing Leadership competences [1]. The leadership model that we are implementing in the Mind Matters game format consists of 6 leadership dimensions: (1) influencing tactics, (2) teams development, (3) enabling cooperation, (4) problem solving, (5) self-management, and (6) accountability. For each leadership competency we are developing a specific Mind Matters module. Module 1: influencing key stakeholder is implemented and currently accessible via our learning management system and deployed within several mayor corporates. In this paper we are introducing our second module: engage and develop teams.

2 Module 2: Engage and Develop Teams

In this Module the various ‘business situations’ are inspired by the 5 layer model for optimal team functioning as put forward by Lencioni [2]: (1) psychological safety – team members feel safe to take risks and be vulnerable in front of each other, (2) dependability – team members get things done on time, (3) structure and clarity – team members have clear roles, plans and goals, (4) meaning – work is personally important

to team members, and (5) impact – team members think their work matters and creates change. The ‘game characters’ that were present in Module 1 are also present in Module 2. The ‘interventions’ are based on the generic teamwork communication model put forward by a variety of authors focusing on (1) content – the ‘what’ in terms of goals, results, vision, problems and solutions (2) process – the ‘explicit how’ in terms of procedures such as rules, planning, roles and responsibilities, and (3) relation – the ‘implicit how’ in terms of interactions driven by concepts such as behaviors, values & convictions, motivations. Each intervention selection has: (1) positive, neutral or negative effects for team spirit, (2) positive, neutral or negative effect for team performance. Players receive in-game and post-game feedback on how the player dealt with the situation: what was done versus what was needed. Additionally, the player is pointed to other educational resources for further own leadership competency development (Fig. 1).

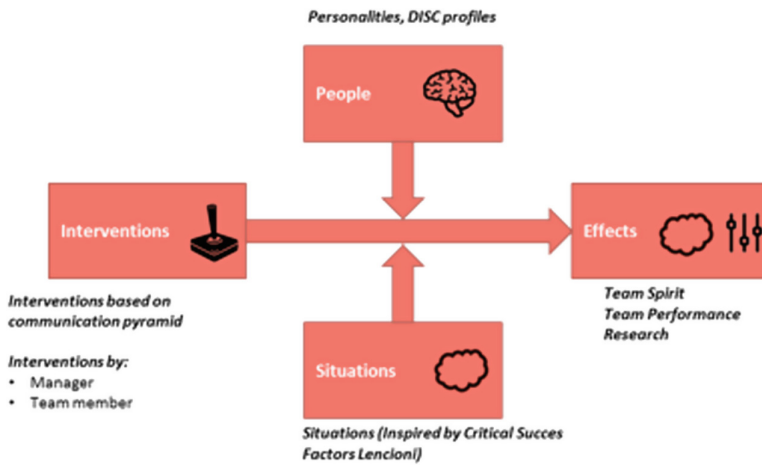


Fig. 1. Situational leadership game model

3 Mind Matters Game

Within Mind Matters, the player assumes the role of a junior researcher in a fictional company. The player’s task is to try out a mind steering device (Fig. 2) by temporarily ‘taking over’ game characters and steering their behaviors. By doing so, the player influences the dialogue between game characters and subsequently, the game narrative.

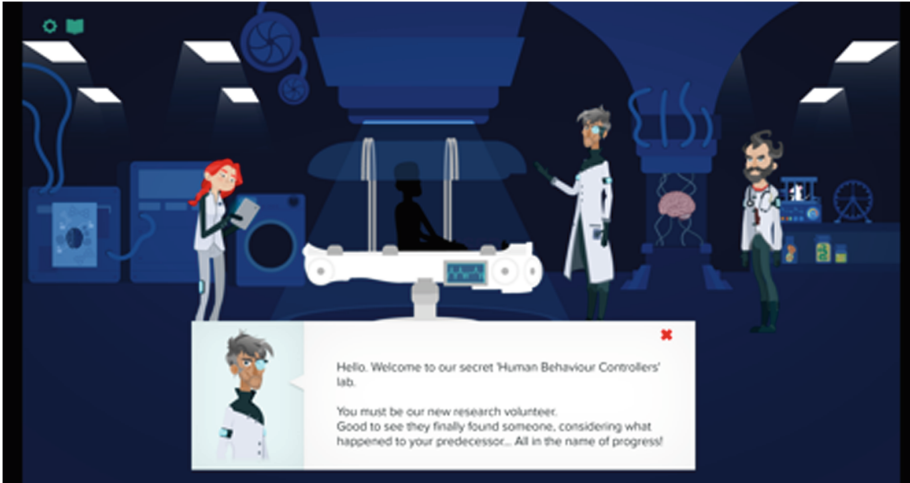


Fig. 2. Mind steering device.

The players are guided to learn about team engagement and team development, by inclusion of two main goals in the game:

- Do research, which translates into gathering and interpreting information as well as experimenting with as many interventions as possible;
- Improve team spirit and team performance, which means trying to find the most effective intervention approach in each situation.

We have chosen a number of relevant business situations and written personnel files for each in-game character. These files describe the personal background of the game characters as well as their competence profiles (Fig. 3).

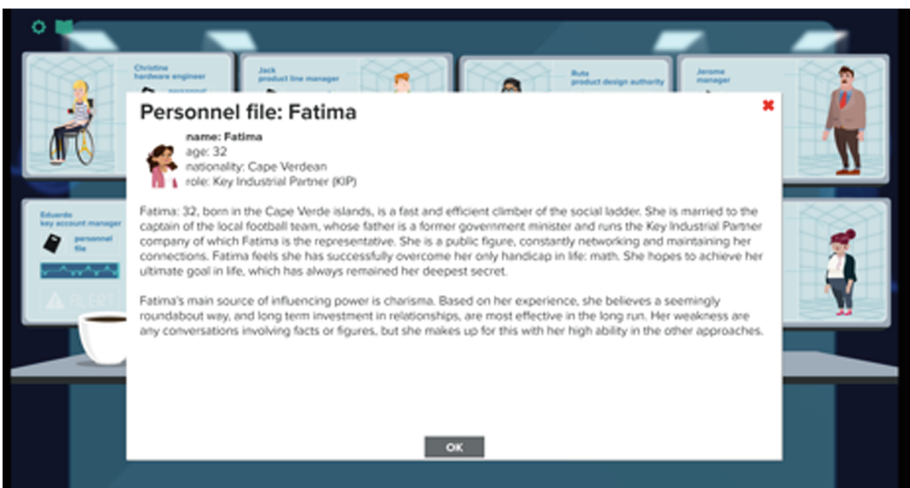


Fig. 3. Personnel files of one of the game characters

The story of Mind Matters unfolds going through these playable situations, in which the game characters act out conflict situations. Players can interfere in each situation from which it is immediately clear that leadership behavior in terms of ‘team engagement and development’ is required (Fig. 4). The player uses the mind-steering device to take control of one of the game characters in a scene, and decide which intervention the character will adapt to. This determines the dialogue, the reaction of the other characters and the resulting story. Game characters are influenceable in various degrees, depending on their profile, their conversation partner, and the situation they are in. In the meantime, players get an overview depicting the key characters and their current state. This also provides an opportunity to reflect on the actions and their consequences, read updated personnel files, as well as to study their score sheet, pertaining to their in-game goals.



Fig. 4. Current state of the influenceable game characters

Apart from being able to control or steer the game characters in their conversations, the mind control device also enables players to read the minds of all characters involved in the scene, including those who are beyond their control. Reading minds shows situational and generic character related information, and writing minds, steers the game character in taking one of four allowed actions. The game flow is depicted in Fig. 5). Figure 5 shows a short part of the dialog just after the situation is explained. In this case the player selects one the characters named Ruta to read her mind, steers her mind based on one of three intervention possibilities, and answers a question that examines if the ‘right’ business situation is recognized.

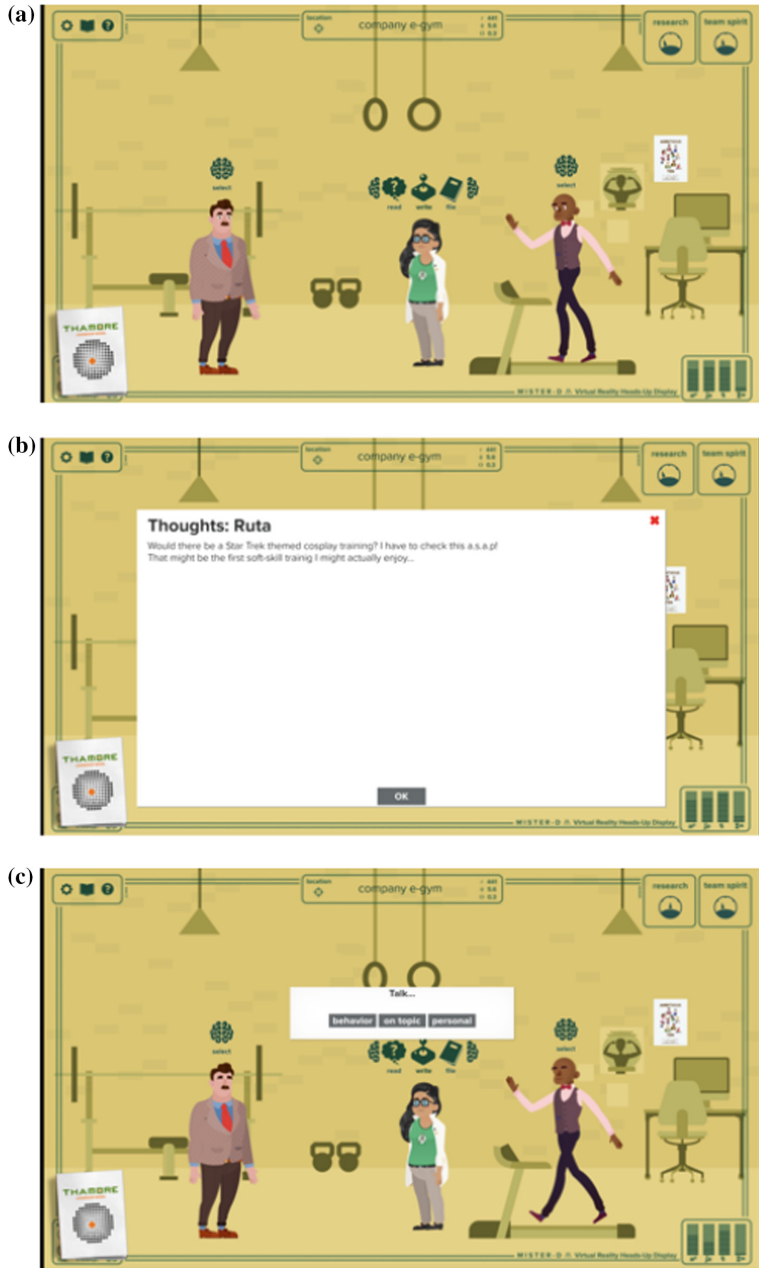


Fig. 5. (a) Characters in the scene. (b) Reading Ruta's thoughts. (c) Selecting one out of three interventions possibilities. (d) Rutas' pre-scripted reply based on the selected intervention. (e) In game feedback based on the selected intervention. (f) Follow-up question relating to 5 layer model by Lencioni & Google. (g) Feedback based on answer

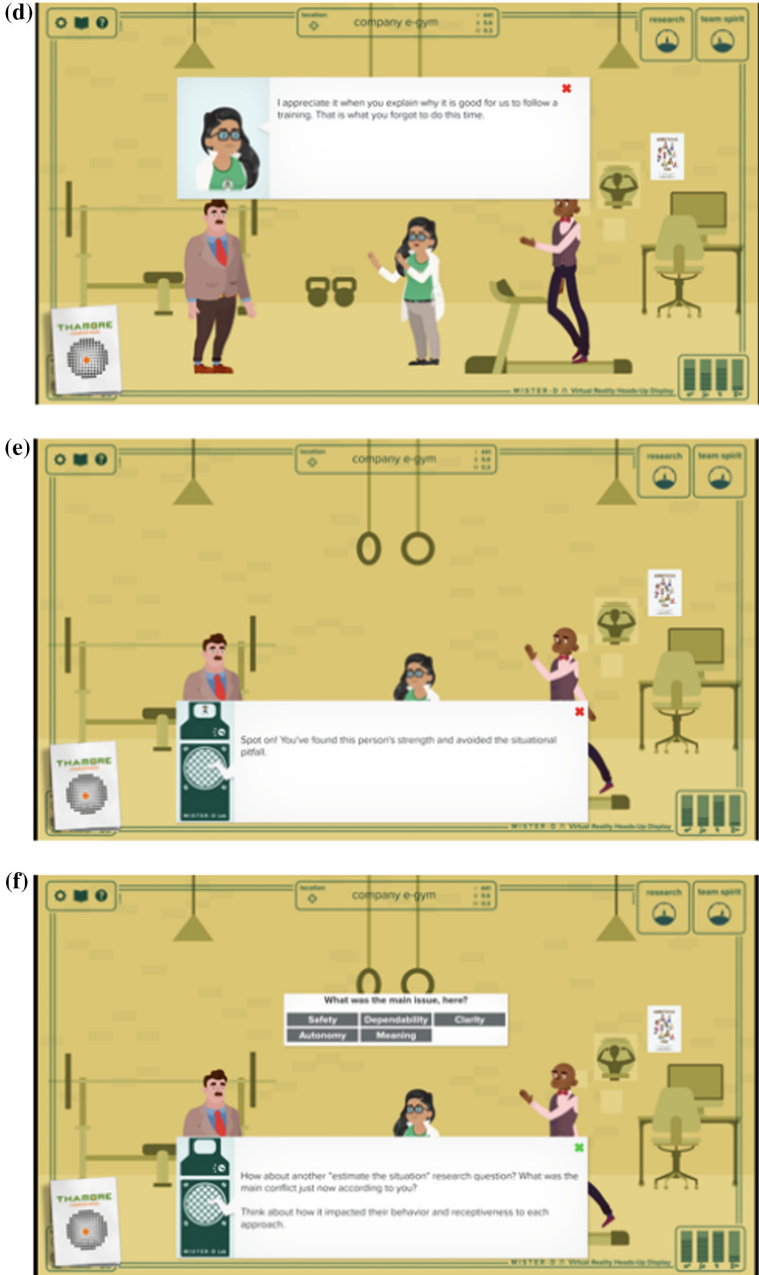


Fig. 5. (continued)



Fig. 5. (continued)

The accumulated scores on these KPIs determine the narrative of the game. Each interactive situation in the game is based on a different conflict between certain game characters.

In total 6 different situations emerge. The game requires about 45 min to play. Trainees are encouraged to consider the given situation, the game characters involved in the conflict, and to think how to approach this situation. Trainees should ponder questions such as:

- What do you want to achieve or want to avoid?
- Do you differentiate in who is saying what?
- Do you take a pro-active or a more reactive approach?
- Do you take into account the possible implications of decisions?

Trainees may play the game in several ways. Initially, they could play the game based on their own insights and frame of reference. Then, they might explore the game model, focusing on maximizing or minimizing their score on one of the KPIs.

Based on the in-game and post-game feedback trainees receive, they are encouraged to think and discuss together (social learning) how they would explain their results, based on the mental image they had initially and their assumptions regarding the factors that influence(d) them.

References

1. De Heer, J., Hryniewicz, R., De Groot, T., Faber, E., Oortwijn, T.: "Mind matters: influencing key stakeholders". In: Leadership Chapter 9, pp. 157–166 (2018). ISBN 978-1-78923-685-9
2. Lencioni, P.: The Five Dysfunctions of a Team. Jossey-Bass (2002). ISBN 0-7879-6075-6



Evaluating the Effectiveness of a Novel Team Development Intervention on Teamwork

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Abstract. The aim of the present research was to determine whether a brief, domain agnostic team training intervention could improve the teamwork of newly formed teams. Eight teams of five participants received training in submarine command and control before being randomly assigned to receive either a teamwork training intervention, or a cognitively matched control. Teamwork behaviors were measured during task performance pre- and post-intervention via observer-rated frequency counts. Preliminary analyses suggest that teams who received this novel intervention improved teamwork behaviors to a greater extent than control teams.

Keywords: Teamwork · Military · Intervention · Training

1 Introduction

Teams are fundamental to society, contributing to our safety, security, and comfort [1]. In high risk, fast paced environments such as the military, healthcare, and aviation, successful outcomes depend not only on the knowledge, skills, and abilities required for individual task performance, but also on the team competencies that enable members to interact interdependently in an effective way; commonly referred to as teamwork [2]. Thus, team members must display both individual expertise (taskwork) and an expertise in teamwork [3]. Failure in these domains is often the result of poor teamwork skills such as communication [4] and can have disastrous consequences. Therefore, there is a compelling need for theoretically underpinned and empirically tested interventions to improve teamwork competencies [3].

Team development interventions generally fall within the categories of either team building (TB) or team training (TT). The principal aim of TB is to enhance interpersonal relations and social interactions [5], utilizing strategies such as goal setting, interpersonal relationship management, role clarification, and problem solving [6]. Conversely, TT adopts a more formal and systematic approach to improving specific team competencies such as communication or coordination. Common, empirically supported, methods include team self-correction; the diagnosis and correction of team problems [7] and team coordination and adaptability training; a focus on training the skills underlying effective coordination [8].

Meta-analytic evidence demonstrates that TB, particularly goal setting and role clarification, can improve interpersonal relations and team affective outcomes [5].

Leadership training has been found to improve leader capabilities and contribute to a host of positive outcomes for followers, teams, and organizations [9]. Even the application of relatively simple, low-cost team development interventions has been found to be effective; for example, team debriefs have been shown to improve team performance by approximately 25% [10]. Most significant is the consistent finding that TT improves teamwork and team performance in medical [11], organizational [12], and military contexts [13]. On average, TT has a greater impact on team cognitive, process, and performance outcomes than TB [14].

Whilst there is strong empirical support for TT, the practice of TT is extremely broad, encompassing a range of learning strategies, methods and teamwork competencies [15]. The means by which TT programs are delivered has been found to be a significant moderator of effectiveness [12, 16]. These include: (1) didactic education or information-based methods, (2) demonstration-based methods, (3) simulation training, and (4) team reviews or debriefs [12, 16].

1.1 Didactic Methods

Didactic methods represent the most basic approach to training teamwork competencies and are widely utilized due to the convenience and low cost of implementation [17]. Training content is provided to team members via PowerPoint, lecture, or in computer-based modules. A good example of such method is the Team Strategies and Tools to Enhance Performance and Patient Safety (TeamSTEPPS) curriculum which consists of four didactic modules covering leadership, situation monitoring, mutual support, and communication [18]. Widespread dissemination of TeamSTEPPS has resulted in significant improvements in teamwork skills and performance in numerous healthcare contexts [19]. However, recent research found TT interventions that targeted didactic instruction alone did not result in significant improvements in teamwork [12]. Whilst TT interventions using didactic methods as the sole method of delivery may be ineffective in inducing changes in teamwork behaviors, there may be value in including them in broader, multimodal TT strategies that also include opportunities to engage in more active learning [12].

1.2 Demonstration-Based Methods

Demonstration-based methods of delivery are more active forms of learning, providing opportunities to observe, hear, and sense teamwork competencies by viewing contextualized examples. Such methods include the use of videos or behavioral modelling. Research that utilized a series of case studies highlighting critical aspects of teamwork found that participants' declarative knowledge of teamwork skills improved, as did their proficiency in planning, coordination, and communication [20].

However, demonstration-based methods are not widely utilized, with only 35% of TT programs reporting demonstration-based activities. This suggests that participants are expected to display teamwork behaviors without having seen how these desired behaviors might manifest themselves in a team task [21]. Recommended best practice for TT is to include video demonstrations in support of the didactic material provided.

1.3 Simulation-Based Methods

It is widely accepted that the most critical TT methods are practice-based, involving role play, guided practice, or most frequently, simulation-based training [17]. Previous reviews found simulation-based activities were adopted in 68% of TT programs [21]. Through experiential activities that require the enactment of various teamwork skills trainees learn from mistakes and refine their skills in a safe environment [22]. Compared with no intervention, simulation-based training has been found to improve knowledge, technical skills, and behavioral learning, whilst also demonstrating a moderately positive effect on patient-related outcomes [23]. Consequently, simulation is a powerful tool to enhance teamwork [22].

1.4 Debriefs

Debriefs have been defined as a type of meeting in which members discuss, interpret, and attempt to learn from recent team events [24]. Since being adopted by the military decades ago, debriefs are widely employed in medical, fire, aviation, education, and a variety of organizational environments as a means of team development [24]. A meta-analysis of 31 studies provides robust evidence for the effectiveness of team debriefs, finding that debriefs improved performance by approximately 25% [10]. In order to have the greatest impact on teamwork and performance, debriefs should involve active self-learning, a developmental intent, focus on specific events, and include multiple information sources [10].

Evidently, TT works but is most effective when the adopted approach includes appropriate instructional strategies, simulation of teamwork activities, and team debriefs [22]. However, reviews of TT consistently find that the literature is plagued with poorly designed studies, many of which lack control groups [22, 25]. The majority of studies fail to describe the content of TT interventions in detail [26] or are specific to the context in which they are administered [27]. Therefore, to advance and evaluate knowledge on the science of team development, more robust experimental designs employing multimethod, domain-agnostic interventions are required.

The overall objective of the present study was to examine the impact of a domain-agnostic TT intervention on teamwork behaviors as scored by expert informant-raters. It was hypothesized that teams receiving the TT intervention would demonstrate a greater improvement in observer-rated teamwork behaviors than teams in the control condition who received no such training.

2 Method

2.1 Participants

Eight newly formed teams of five, randomly allocated participants took part in the present research. Four teams were randomly assigned to the experimental condition (TT intervention), and four teams were randomly assigned to the no-training control condition. Participants ($n = 40$, male = 13, female = 27) were recruited from a large university in the United Kingdom and were aged between 18 and 54 years (Mage = 23.68, SD = 8.36).

The research laboratory utilized is affiliated with the British military, thus only Commonwealth nationals were eligible to participate. Furthermore, due to the nature of the tasks, participants were excluded if English was not their first language, they had been a member of the military or had previously received teamwork training.

2.2 Procedure

The research took place in a submarine control room simulator designed and built by the research team [28]. The simulator comprised of a network of workstations running Dangerous Waters, a naval warfare simulation. Upon arrival to the simulator participants were randomly allocated to one of the following team roles: Target Motion Analysis 1 or 2 (TMA1, TMA2), Coordinator (team leader), Sonar Operator 1 or 2 (SO1, SO2). Participants received individual training for their assigned role that included a tutorial and opportunity to interact with Dangerous Waters. An assessment of each operator’s competence was undertaken to ensure sufficient knowledge had been acquired to adequately perform the role.

Following a short break, participants completed a submarine command and control scenario as a team. This 20-min task required sonar operators to designate and classify contacts and generate speed and course estimates. The TMA operators were required to plot the estimated behavior of all contacts, whilst the coordinator managed effective transfer of information. Teamwork behaviors were measured throughout by two observers, and team performance was assessed upon conclusion of the scenario.

The four teams allocated to the experimental condition then received the TT intervention, whilst four teams allocated to the control condition undertook a series of tasks, as individuals, that were matched for both time and cognitive load. This part of the experiment lasted approximately ninety minutes and is detailed further below.

All teams then completed a second submarine command and control scenario where positions, speeds, etc. of contacts was different. Presentation of the two scenarios was counterbalanced across teams to avoid scenario practice effects. Finally, an experimental debrief was delivered to all participants to provide further details on the nature of the research. The research design is illustrated below in Fig. 1.

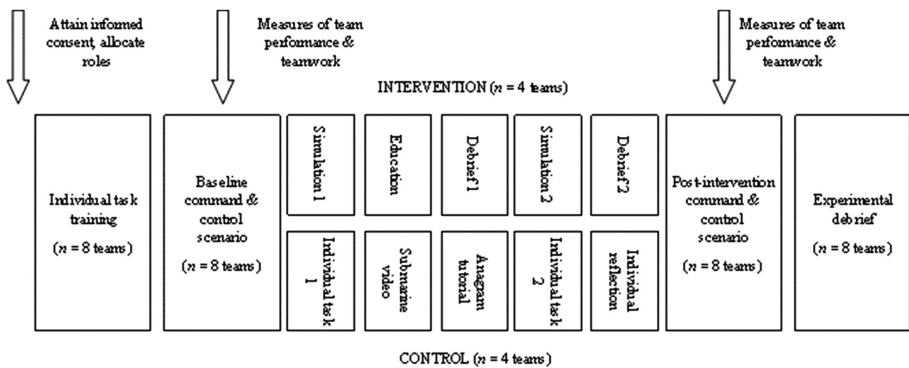


Fig. 1. Diagrammatic representation of study design

2.3 Intervention

In line with the aforementioned recommendations a TT intervention consisting of a simulation, education about teamwork, and team debriefs was employed. Table 1 provides an overview and comparison of both experimental and control conditions.

Table 1. Overview of both experimental and control conditions

Time (min)	Experimental: team training	Control: no training
20	<p>Simulation 1, team anagram task Participants solved anagrams and shared these with the team to construct three sentences. Information was distributed amongst the team. The coordinator made sense of the information and constructed all sentences. A team score was awarded</p>	<p>Individual anagram task 1 The same words and sentences were used as the experimental condition, but individual operators had all the information needed to complete the task individually. All participants worked alone on this task and received individual scores</p>
20	<p>Teamwork video An educational video provided an overview of the Big Five model of teamwork. Content included definitions and examples of each of the associated behaviors</p>	<p>Submarine video Participants watched a 20-min excerpt of a documentary about nuclear submarines</p>
15	<p>Experimenter-led debrief The team participated in a debrief that reviewed teamwork, focusing on the Big Five behaviors and goals for improvement</p>	<p>Anagram solving tutorial Participants watched a video that provided advice and helpful tips to improve their individual anagram solving ability</p>
20	<p>Simulation 2, team anagram task Teams completed a second anagram task with different words and sentences</p>	<p>Individual anagram task 2 Participants completed a second anagram task with different words and sentences</p>
15	<p>Coordinator-led debrief The coordinator led a debrief following a similar format to that led by the experimenter. Goals were set in relation to the forthcoming submarine scenario</p>	<p>Reflection Participants completed a worksheet with a number of questions that asked them to reflect on their anagram solving skills and performance over the two tasks</p>

Simulation. To isolate the measurement and development of teamwork, it is important to separate taskwork competencies from teamwork training where possible. Therefore, the present research sought to deliver a domain-agnostic simulation that was not reliant upon trained taskwork competencies. To that end, a task was designed that required participants to solve anagrams (similar to processing data in the submarine roles), share information across the team (as required in the command and control task), before working collaboratively to link solved anagrams and construct three sentences

(analogous to the creation of a tactical picture). Sentences were linked by one final solution that teams were required to work together to determine. Figures 2 and 3 provide an example of team member and coordinator computer interfaces.



Fig. 2. Team member anagram screen

Education. Teams were shown a 20-min video based on the widely utilized Big Five model of teamwork which proposes five factors that are critical to enabling teams to coordinate effectively; leadership, backup behavior (BuB), mutual performance monitoring (MPM), adaptability, and team orientation [29]. These constructs are, in turn, facilitated by three coordinating mechanisms; shared mental models (SMM), closed-loop communication, and mutual trust. This model has been widely adopted in healthcare, informing the development of the TeamSTEPPS program [19]. The education video introduced and defined each of the big five and coordinating mechanisms and provided pertinent examples of these behaviors during a team task.

Debrief. Debriefs are thought to improve team performance through the provision of feedback, observational learning, and use of goal setting [30]. As such, the debriefs delivered in the present research included (a) provision of feedback from the lead author, an experienced Performance Psychologist, (b) observations and reflections from all team members, (c) identification of goals for improvement to be implemented in the team task that followed. As the educational component was based on the Big Five model, the debrief facilitated discussion around the eight teamwork competencies, identifying positive instances of such behaviors, and instances where these behaviors could have been utilized to greater effect. The first debrief was led by the first author and the second was led by the assigned coordinator.

2.4 Control

To ensure cognitive matching, teams allocated to the control condition were required to complete the same anagram task as those in the experimental condition. However, participants received all 48 anagrams that, in the experimental condition, were distributed amongst team members. Control participants were required to solve all anagrams, collate the three sentences and determine the final solution individually.

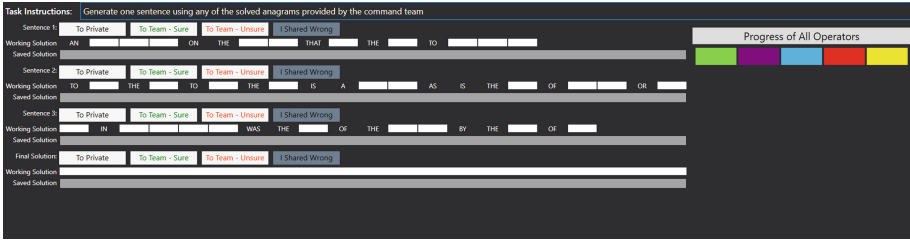


Fig. 3. Coordinator anagram screen

Upon completion of the anagram task teams watched a 20-min video about naval submarines. The video made no reference to teamwork, or the specific roles required of the participants. In place of the first debrief teams in the control condition watched a video of strategies to solve anagrams. Participants then completed a second anagram task with different words and solutions, again counterbalanced, before completing a written reflection on their performance in the anagram tasks. There was no interaction between team members throughout the 90-min period of the control condition.

2.5 Measures

A common criticism directed at the measurement of teamwork is that there is an overreliance on self-report measures [31]. Therefore, based on best practice recommendations [32] the research team developed a unique observational measure of the Big Five model of teamwork, grounded in the original behavioral definitions proposed by Salas et al. [29]. During performance of the command and control scenarios observers rated the frequency with which behaviors related to each of the Big Five and coordinating mechanisms were displayed. All items were selected as a result of a thorough literature review which provided a concise definition of each teamwork construct and the behaviors that would typically be observed. For example, one leadership item was, ‘*Direction provided by designated leader*’. Shared mental models was assessed via the item, ‘*Task information is shared*’. Sixteen behavioral markers (two for each of the big five and coordinating mechanisms) were tallied by two observers with extensive experience of working with teams.

3 Results

Table 2 provides the maximum and mean of all scores for the eight teamwork behaviors subsumed within the Big Five framework. Eight teams were observed on two occasions (pre- and post-intervention), resulting in a total of 16 observations.

Table 2. Means and standard deviations of all teamwork scores

		Max.	Mean	SD.	Mean E.	Mean C.
Trust	Mistake admitted	12	4.06	3.22	3.5	6
	Help requested	18	10.19	3.63	11.25	10.25
SMM	Task related elements	56	29.81	11.9	35.25	34.75
	Time constraints	9.5	0.81	2.38	3.13	0
Communication	Information	15	8.56	3.9	8.63	11.5
	Acknowledge comm.	32	20.63	7.53	21.5	26.5
Adaptability	Reports of change	5	2.03	1.8	3.5	3.75
	Alternate strategies	12	2.75	2.9	1.63	6
BuB	Reallocation tasks	6	1.47	1.6	2.63	1.5
	Support provision	14	7.06	3.42	9.38	8
MPM	Mistake identification	11	3.69	3.05	4	4
	Team member check	34	21.78	7.17	20.75	24
Leadership	Goal setting	19	10.03	4.42	13.38	9.75
	Feedback	19	8.28	5.43	8.63	9.75
Team orientation	Competitive behavior	27.5	9.09	8.44	-4.13	-4
	Inhibiting actions	9	2.31	2.43	-2.88	-1.75

NB. Shared mental models (SMM), Backup behavior (BuB), Mutual performance monitoring (MPM), Experimental teams (E.), Control teams (C.)

Given the limited sample size it was not possible to run statistical tests of significance on the data. Instead, the change in teamwork observation scores was calculated for all teams by subtracting the pre-intervention rating from the post-intervention rating. The mean interrater agreement between observers across all observations was 0.81, $p < 0.01$, therefore the average of both raters' scores was taken.

Figure 4 illustrates the mean change in score across the eight teamwork behaviors for the experimental and control teams. Other than trust, all aspects of teamwork increased pre- to post-intervention. Experimental teams demonstrated a greater improvement in all teamwork skills other than adaptability and MPM. The greatest improvement was evident in experimental teams' SMM.

Figure 5 illustrates the difference in scores for all teamwork skills pre- to post-intervention. Teams are represented by the NATO phonetic alphabet, alternating in letter for experimental versus control conditions. Experimental teams are displayed in varying shades of blue, and control teams in varying shades of orange. Although most teams demonstrated an improvement in teamwork from pre- to post-intervention, this change was generally greater in the experimental teams.

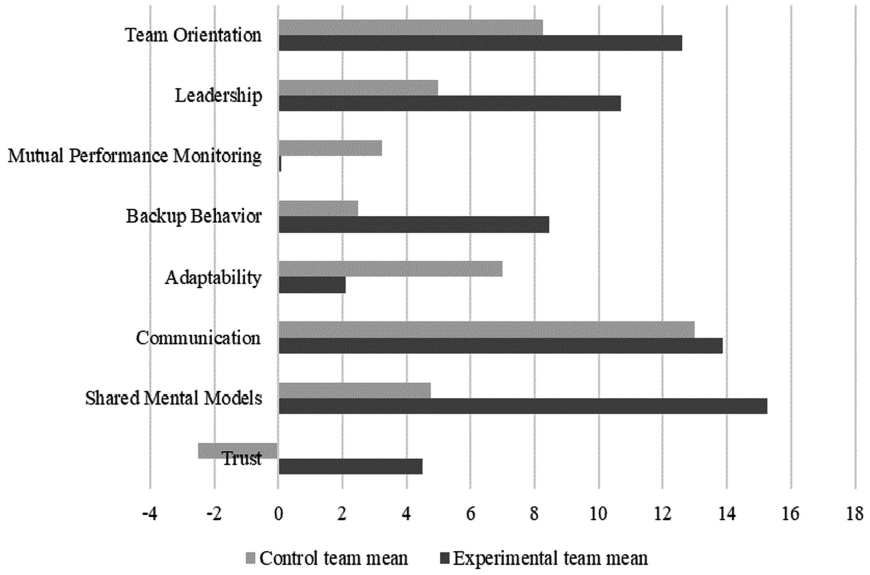


Fig. 4. Comparison of mean differences pre- to post-intervention

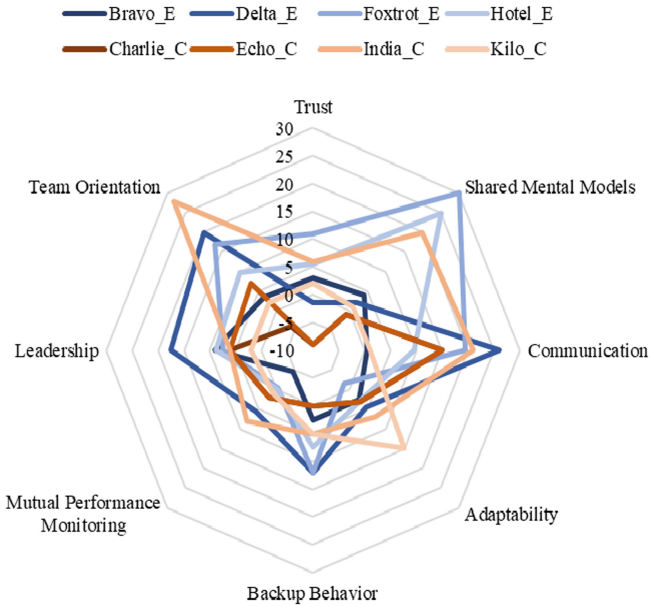


Fig. 5. Difference in all team scores pre- and post-intervention

4 Discussion

The present research sought to determine whether a novel, domain-agnostic TT intervention would improve the teamwork behaviors of newly formed teams. The results provide preliminary evidence to support the application of this type of multi-modal TT intervention, with experimental teams demonstrating an increase in all teamwork behaviors. It was expected that the teamwork of most teams would improve across the two team tasks as team and task familiarity increased, however there was a tendency for experimental teams to improve their teamwork behaviors to a greater extent than control teams. The findings add to the existing body of literature that has consistently demonstrated the effectiveness of TT interventions in improving teamwork behaviors; particularly the use of experiential simulations that enable members to practice teamwork skills [3, 11, 12, 22].

The most pronounced findings were the reduced levels of mutual trust displayed by a number of control teams from pre- to post-intervention, and the increase in use of SMM by experimental teams. These findings are particularly noteworthy because both trust and SMMs have been found to be fundamental to team effectiveness [33, 34]. Indeed, higher levels of trust enable greater information exchange, which in turn facilitates the development of SMMs [33]. It could be surmised, therefore, that the lower levels trust demonstrated by teams who had not received the TT intervention impeded the development of SMMs relative to the experimental teams. Furthermore, whilst it is not possible to separate out the effect of the various components of the intervention, it is reasonable to believe that participation in debriefs and goal setting contributed to the greater development of SMMs in the experimental teams [30].

Interestingly, control teams appeared to increase MPM more than experimental teams. Although Salas [29] regards monitoring as a positive teamwork behavior, previous research has found an inverse relationship between trust and monitoring, in that teams with lower levels of trust report higher levels of monitoring behavior [35]. Therefore, control teams may have been checking each other's work more because they had lower levels of trust in their team members' competence and ability.

Whilst the observer-rated frequency counts appeared to yield some interesting data in relation to the various teamwork behaviors, the difference in means across these behaviors must be emphasized. Information that was *exchanged in relation to the task* resulted in higher SMM ratings, and the coordinator being able to see duplicate screens of all operators would have likely inflated the *team member checking* element of MPM ratings. Conversely, only a single manipulation (e.g., turning off operator monitors) required teams to adapt, thus leading to a lower rating of both behaviors pertaining to adaptability. The number of opportunities to rate the various teamwork behaviors throughout the task was unequal, thus would need to be addressed in further validation of this type of measure. Indeed, this is a limitation of the measurement approach adopted.

Further limitations include the modest sample size. A greater number of teams will be recruited in due course to provide appropriate statistical power to conduct parametric analyses on the data. Task performance data will also be collected in order to analyze the extent to which teamwork behaviors are associated with team task performance.

Finally, given the small sample size, and use of novice, student participants in a low-fidelity simulator, it is difficult to make any broad generalizations about the applicability of the results. Therefore, future research would be well served to implement the TT intervention designed with a variety of teams in a field-based setting. This would provide invaluable data about the efficacy of domain-agnostic interventions in a more naturalistic setting. It would also be insightful for future research endeavors to examine the relative effects of each different element of the intervention, particularly the novel, anagram simulation.

4.1 Conclusion

The results presented herein provide initial support for the efficacy of a novel TT intervention that includes simulation, education, and debriefing. The value of such intervention is that it is straightforward to administer with a range of different teams, regardless of the taskwork required of team members. This is because the intervention trains core teamwork competencies that are transportable [29]. However, further research is required before more definite conclusions can be drawn.

References

1. Salas, E., Reyes, D.L., McDaniel, S.H.: The science of teamwork: progress, reflections, and the road ahead. *Am. Psychol.* **73**(4), 593–600 (2018)
2. Salas, E., Rosen, M.A., Burke, C.S., Goodwin, G.F.: The wisdom of collectives in organizations: an update of the teamwork competencies. In: Salas, E., Goodwin, G.F., Burke, C.S. (eds.) *Team Effectiveness in Complex Organizations: Cross-Disciplinary Perspectives and Approaches*, pp. 39–79. Psychology Press, New York (2009)
3. Lacerenza, C.N., Marlow, S.L., Tannenbaum, S.I., Salas, E.: Team development interventions: evidence-based approaches for improving teamwork. *Am. Psychol.* **73**(4), 517–531 (2018)
4. Salas, E., Burke, C.S., Bowers, C.A., Wilson, K.A.: Team training in the skies: does crew resource management (CRM) training work? *Hum. Factors* **43**(4), 641–674 (2001)
5. Klein, C., DiazGranados, D., Salas, E., Le, H., Burke, C.S., Lyons, R., Goodwin, G.F.: Does team building work? *Small Group Res.* **40**(2), 181–222 (2009)
6. Buller, P.F., Bell Jr., C.H.: Effects of team building and goal setting on productivity: a field experiment. *Acad. Man. J.* **29**(2), 305–328 (1986)
7. Smith-Jentsch, K.A., Zeisig, R.L., Acton, B., McPherson, J.A.: Team dimensional training: a strategy for guided team self-correction. In: Cannon-Bowers, J.A., Salas, E. (eds.) *Making Decisions Under Stress: Implications for Individual and Team Training*, pp. 271–297. American Psychological Association, Washington, DC (1998)
8. Salas, E., Nichols, D.R., Driskell, J.E.: Testing three team training strategies in intact teams: a meta-analysis. *Small Group Res.* **38**(4), 471–488 (2007)
9. Lacerenza, C.N., Reyes, D.L., Marlow, S.L., Joseph, D.L., Salas, E.: Leadership training design, delivery, and implementation: a meta-analysis. *J. Appl. Psychol.* **102**(12), 1686–1718 (2017)
10. Tannenbaum, S.I., Cerasoli, C.P.: Do team and individual debriefs enhance performance? A meta-analysis. *Hum. Factors* **55**(1), 231–245 (2013)

11. Hughes, A.M., Gregory, M.E., Joseph, D.L., Sonesh, S.C., Marlow, S.L., Lacerenza, C.N., Benishek, L.E., King, H.B., Salas, E.: Saving lives: a meta-analysis of team training in healthcare. *J. Appl. Psychol.* **101**(9), 1266–1304 (2016)
12. McEwan, D., Ruissen, G.R., Eys, M.A., Zumbo, B.D., Beauchamp, M.R.: The effectiveness of teamwork training on teamwork behaviors and team performance: a systematic review and meta-analysis of controlled interventions. *PLoS ONE* **12**(1), e0169604 (2017)
13. Goodwin, G.F., Blacksmith, N., Coats, M.R.: The science of teams in the military: contributions from over 60 years of research. *Am. Psychol.* **73**(4), 322–333 (2018)
14. Shuffler, M.L., DiazGranados, D., Salas, E.: There's a science for that: team development interventions in organizations. *Curr. Dir. Psychol. Sci.* **20**(6), 365–372 (2011)
15. Cannon-Bowers, J.A., Salas, E.: Teamwork competencies: the interaction of team member knowledge, skills, and attitudes. In: O'Neil Jr., H.F. (ed.) *Workforce Readiness: Competencies and Assessment*, pp. 151–174. Psychology Press, New York (1997)
16. Weaver, S.J., Dy, S.M., Rosen, M.A.: Team-training in healthcare: a narrative synthesis of the literature. *BMJ Qual. Saf.* **23**(5), 359–372 (2014)
17. Weaver, S.J., Rosen, M.A., Salas, E., Baum, K.D., King, H.B.: Integrating the science of team training: guidelines for continuing education. *J. Contin. Educ. Health Prof.* **30**(4), 208–220 (2010)
18. King, H.B., Battles, J., Baker, D.P., Alonso, A., Salas, E., Webster, J., Toomey, L., Salisbury, M.: TeamSTEPPS: team strategies and tools to enhance performance and patient safety. In: Henriksen, K., Battles, J.B., Keyes, M.A., Grady, M.L. (eds.) *Advances in Patient Safety: New Directions and Alternative Approaches. Performance and Tools*, vol. 3. Agency for Healthcare Research and Quality, Rockville (2018)
19. Lisbon, D., Allin, D., Cleek, C., Roop, L., Brimacombe, M., Downes, C., Pingleton, S.K.: Improved knowledge, attitudes, and behaviours after implementation of TeamSTEPPS training in an academic emergency department: a pilot report. *Am. J. Med. Qual.* **31**(1), 86–90 (2016)
20. Ellis, A.P., Bell, B.S., Ployhart, R.E., Hollenbeck, J.R., Ilgen, D.R.: An evaluation of generic teamwork skills training with action teams: effects on cognitive and skill-based outcomes. *Pers. Psychol.* **58**(3), 641–672 (2005)
21. Weaver, S.J., Lyons, R., DiazGranados, D., Rosen, M.A., Salas, E., Oglesby, J., Augenstein, J.S., Birnbach, D.J., Robinson, D., King, H.B.: The anatomy of health care team training and the state of practice: a critical review. *Acad. Med.* **85**(11), 1746–1760 (2010)
22. Salas, E., Zajac, S., Marlow, S.L.: Transforming health care one team at a time: ten observations and the trail ahead. *Group Organ. Manag.* **43**(3), 357–381 (2018)
23. Cook, D.A., Hatala, R., Brydges, R., Zendejas, B., Szostek, J.H., Wang, A.T., Erwin, P.J., Hamstra, S.J.: Technology-enhanced simulation for health professions education: a systematic review and meta-analysis. *JAMA* **306**, 978–988 (2011)
24. Allen, J.A., Reiter-Palmon, R., Crowe, J., Scott, C.: Debriefs: teams learning from doing in context. *Am. Psychol.* **73**(4), 504–516 (2018)
25. Miller, C.J., Kim, B., Silverman, A., Bauer, M.S.: A systematic review of team-building interventions in non-acute healthcare settings. *BMC Health Serv. Res.* **18**(1), 146–167 (2018)
26. Gordon, M., Darbyshire, D., Baker, P.: Non-technical skills training to enhance patient safety: a systematic review. *Med. Educ.* **46**(11), 1042–1054 (2012)
27. Gillespie, B.M., Chaboyer, W., Murray, P.: Enhancing communication in surgery through team training interventions: a systematic literature review. *AORN J.* **92**(6), 642–657 (2010)
28. Roberts, A., Stanton, N.A., Fay, D.: The command team experimental test-bed stage 1: design and build of a submarine command room simulator. *Proc. Manuf.* **3**, 2800–2807 (2015)

29. Salas, E., Sims, D.E., Burke, C.S.: Is there a “big five” in teamwork? *Small Group Res.* **36**(5), 555–599 (2005)
30. Villado, A.J., Arthur, W.: The comparative effect of subjective and objective after-action reviews on team performance on a complex task. *J. Appl. Psychol.* **98**(3), 514–528 (2013)
31. Marlow, S., Bisbey, T., Lacerenza, C., Salas, E.: Performance measures for health care teams: a review. *Small Group Res.* **49**(3), 306–356 (2018)
32. Rosen, M.A., Salas, E., Wilson, K.A., King, H.B., Salisbury, M., Augenstein, J.S., Robinson, D.W., Birnbach, D.J.: Measuring team performance in simulation-based training: adopting best practices for healthcare. *J. Soc. Simul. Health* **3**(1), 33–41 (2008)
33. Grossman, R., Feitosa, J.: Team trust over time: modeling reciprocal and contextual influences in action teams. *Hum. Res. Manag. Rev.* **28**(4), 395–410 (2018)
34. Lim, B.C., Klein, K.J.: Team mental models and team performance: a field study of the effects of team mental model similarity and accuracy. *J. Organ. Behav. Int. J. Ind. Occup. Organ. Psychol. Behav.* **27**(4), 403–418 (2006)
35. Costa, A.C., Bijlsma-Frankema, K., de Jong, B.: The role of social capital on trust development and dynamics: implications for cooperation, monitoring and team performance. *Soc. Sci. Inf.* **48**(2), 199–228 (2009)



Validation of Employee Engagement Framework

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Abstract. This study validates the employee engagement framework of the impact of training and development, digital capability, workplace spirituality, and reward and recognition on the employee engagement in the Saudi Arabian public healthcare. This research used a questionnaire to collect data from 235 employees in healthcare sector. Having used multivariate analyses, such as exploratory factor analysis, confirmatory factor analysis, and structural equation modelling to analyze the data collected, it was found that digital capability and workplace spirituality significantly contributed to employee engagement in Saudi Arabian healthcare sector. In addition, it was also found that job satisfaction partially mediate the relationships between digital capability and employee engagement, as well as workplace spirituality and employee engagement.

Keywords: Employee engagement · Human resource · Development · Digital capability · Workplace spirituality · Job satisfaction

1 Introduction

With the views that organizations can leverage on employee engagement for positive outcomes, such as increase in patient safety, higher employee retention, greater patient satisfaction, improve in financial performance, et cetera; employee engagement has grown in popularity and acceptance by several organizations, including those in the healthcare sector [1, 2]. Amid this popularity and acceptance of employee engagement, several factors that could contribute to it (employee engagement) have been developed and used extensively by various researchers. However, it is becoming increasingly apparent that recently coined factors into this area of study, such as digital capability and workplace spirituality [3, 4], are constantly ignored when validating a model to measure employee engagement. On this basis, it is imperative to measure the level of these factors, together with other prominent factors, like training and development, and reward and recognition, within the healthcare sector.

While the much-touted benefits of employee engagement are well reported in the academic literature, the importance of this managerial tool is underreported in the healthcare sector, even though creating engagement culture is truer in this sector than the

other sectors. Also in the face of cost pressure, healthcare sector is constantly mandated to attract and retain competent clinical, professional, and technical talent [5]. Meanwhile, several studies have developed and validated model for measuring employee engagement. For example, Wiley et al. [2] developed and validated a global employee engagement model; Imandin, Bisschoff and Botha [6] validated a model to measure employee engagement; Witemeyer [7] validated instrument for employee engagement; Nienaber and Martins [8] validated a scale for measuring employee engagement in the context of South Africa. Since healthcare sector is a technology driven sector and where workplace spirituality play an important role in getting employees engaged [8]; also, there is no existence of consistently-accepted conceptualization of the construct, particularly in the healthcare sector [7]. On this basis, the researchers have set out to develop and validate an appropriate model to measure employee engagement in the healthcare sector. Although there is a myriad of studies on validating factors that could contribute to employee engagement, none of which has incorporated digital capability and workplace spirituality, as well as using job satisfaction as mediator while developing and validating constructs for employee engagement in the healthcare sector.

2 Literature Review

Employee engagement is related to employee-organization alignment, whereby employees are committed to their jobs and organizations, willing to advocate the benefits for working in organizations, show satisfaction with their jobs, and feeling pride for working in the organizations [9]. Employee engagement is also related to positive attitude of employees towards the values of organization [10]. This concept is key to healthcare sector to reduce labour turnover, increase workers' productivity and retention, patient safety, and greater patient satisfaction. There are several factors that contribute to employee engagement that include training and development [11], digital capabilities [3], workplace spirituality [12], and job satisfaction [13], reward and recognition [14–16]. Following this, conceptual framework is presented, and hypotheses are developed.

2.1 Training and Development and Employee Engagement

Training and development has been proven to be key element to enhance employee engagement [17]. As stated by Nawaz, Hassan, Hassan, Shaukat and Asadullah [18], employees are able to acquire technical skills, solid knowledge, and interpersonal skills in the training process; thus, employees with these skills and knowledge are able to carry out their jobs efficiently and effectively at workplace, leading to engagement. In contrast, lack of training and development programmes could lead to less engagement and performance [18]. In addition, training and development is also used to sharpen thinking ability and creativity of employees to take better decision, become more productive, get the most from the abilities of their employees, and prepare them to carry out their jobs as desired [19]. Therefore, it is generally believed that training and development has capacity to increase, to some degree, employee engagement, and subsequently organizational performance [20].

H₁: Training and development is positively associated with employee engagement.

2.2 Digital Capability and Employee Engagement

Digital capabilities has been defined by JISC [21] as those capabilities that are required for living, learning, and working in a digital environment. Also referred to as digital literacies, digital capabilities can be grouped into six main areas: information, media, and data literacy; creation, scholarship, and innovation; communication, participation, and collaboration; learning and personal/professional development; digital identity and wellbeing; and Information and communications technology proficiency. Organizations with right strategies on digital capabilities perform better and have more engaged employees [22]. Due to digital capability, the world of information useful in getting employee engaged are made available at their fingertips, since employee can now collaborate with other colleagues across the globe and solve problems together [4, 22].

H₂: Digital capability is positively associated with Employee Engagement.

2.3 Workplace Spirituality and Employee Engagement

Workplace spirituality is another important factor capable of impacting employee engagement as noticed in the literature. Kinjerski and Skrypnek [23] define workplace spirituality as “the experience of employees who are passionate about and energized by their work, find meaning and purpose in their work, feel that they can express their complete selves at work, and feel connected to those with whom they work.” As argued by Kinjerski and Skrypnek [23], exhibition of spirituality in an organization “create an environment where integration of the personal and professional selves are possible, engaging the whole person in the work process.” According to Devendhiran and Wesley [12], workplace spirituality is not to promote a particular ideological system at work, but it is to create a culture that recognizes employees’ spirit at work. Thus, including this factor in this study is expected to provide result on the impact of workplace spirituality on employee engagement in a context like Saudi Arabia.

H₃: Workplace spirituality is positively associated with Employee Engagement.

2.4 Reward and Recognition and Employee Engagement

Reward and recognition has been identified as an important contributor to employee engagement. Reward and recognition are motivational tools to fuel the employees’ desire to excel, exceed expectations, enhance team success, build their self-esteem, and get them engaged. Reward and recognition cover both intrinsic and extrinsic aspects, including team incentives, profit sharing, stock ownership, pay, promotion, praise, and recognition [15]. They also show a greater understanding of their works and objectives, and they are more likely to be engaged in their respective work [24]. Several studies, such as the studies of Presbitero [14], Soliman and Wahba [25] and Taneja et al. [26], have shown that reward and recognition are related to employee engagement in various

organizational settings. Cooper-Thomas et al. [27] also show that reward and recognition are related to employee engagement.

H₄: Reward and recognition is positively associated with Employee Engagement.

2.5 Job Satisfaction and Employee Engagement

Finally, job satisfaction is another factor which has been identified in the literature as having positive effect on employee engagement [13]. The more the organization is committed in taking care of its employees’ needs and values, the more employees satisfied with their jobs and the more they become engaged [28, 29]. Abraham [28] notes that only satisfied employees through high quality support services and policies would become engaged with their works; as such, loyal, satisfied, and productive employees would create value. Since job satisfaction is a key to employee engagement, and given that the government of Saudi Arabia is doing everything possible to ensure job satisfaction at the healthcare sector; the researcher has deemed it fit to investigate the impact of job satisfaction on the employee engagement in the Saudi Arabian healthcare sector [30]. Meanwhile, the below Fig. 1 represents a conceptual framework that was developed to guide this study on the model for measuring employee engagement in the healthcare sector.

H₅: Job satisfaction mediate the relationships between other factors and Employee Engagement



Fig. 1. Conceptual framework

3 Methodology

3.1 Research Design, Population, and Sample Size

This study adopts quantitative research design in its quest to validate a model for measuring employee engagement in healthcare sector. By so doing, the study has followed a way of cross-sectional and correlational. In addition, the researchers have used purposive sampling to draw data from the employees who are currently working in the healthcare sector in Saudi Arabia. According to Collins et al. [31], and Teddlie and Yu [32], purposive sampling is a sample selection procedure used for choosing settings or groups that are professional on a specific area of study. Moreover, the study’ population are health workers in the Saudi Arabia. In the same vein, data were collected

from a sample of 235 health workers using purposive sampling technique. Before embarking on analyzing the data collected, data were screened for possible unengaged responses, missing data, and outliers; but no response was deleted in the process, representing 100% response rate. Hence, the entire data collected were used for this study and this was achieved due to several callbacks and follow-up by the researchers on the respondents. As expected, a high rate of response is likely if questionnaire is used to solicit respondents' views, according to [33].

3.2 The Questionnaire and Variables Measurement

A research instrument – survey questionnaire – was developed with closed ended questions on a 5-point Likert scale. The questionnaire developed was later translated from English to Arabic on a back to back basis, since the study's respondents are Arabic speakers. The researchers developed questionnaire after reviewing existing literature on the employee engagement and other variables. Various items in the questionnaire used for this study were adapted from various past studies [34, 40], training and development [14, 25, 36], digital capability [37], workplace spirituality [38], reward and recognition [25], and job satisfaction [16, 36, 39]. While questionnaire can be open ended or close ended, the researchers have adopted the later as a result of the fact that the present study intends to analyze the extent of agreement or disagreement with the various close ended questions in the developed questionnaire.

On validity and reliability of the instrument of this study, the questionnaire developed was validated through the development of scales and then sending it to experts in this field; as such, the comments received were considered and incorporated before subjecting the instrument developed for data collection. Similarly, Cronbach's (α) was used in measuring reliability for this study. All the values obtained are well above the benchmark of 0.7; specifically, workplace spirituality (0.895), reward and recognition (0.900), digital capability (0.865), employee engagement (0.833), training and development (0.812), job satisfaction (0.873). The results of the reliability tests are reported in Table 1 below.

Table 1. Reliability test

S/N	Variable	Number of item	Cronbach's alpha
1	Workplace spirituality	6	0.895
2	Reward and recognition	5	0.900
3	Digital capability	4	0.865
4	Employee engagement	5	0.833
5	Training and development	5	0.812
6	Job satisfaction	3	0.873

4 Analysis and Findings

As mentioned, questionnaires were used to collect data from 235 health workers from Saudi Arabia. Of the 235 health workers that participated in this study, 70.6% of them are male and 27.4% are female. Regarding the age group of the respondents, about 46% of the total respondents belong to 31–40 age group, approximately 33% are in 41–50 age group, 11.1% are within the age group of 20–30, 8.5% are in age group of 51–60, while only one respondents is above 60 years age group with less than 1%. This suggests that majority of the healthcare workers in Saudi Arabia are within the age group of 31–40 and 41–50. In terms of the respondents' professional experience, 26.8 have been working in healthcare sector for the past 21 and above years, 32.4% indicated that they have been working in this sector for the past 11–15 years, 21% have been working here for the past 16–20 years, 20.9% have been working in this sector for the past 6–10 years, and 6.8% have been working in this sector since about one to five years. Moving to the respondents' educational level, approximately 43% of them are degree holders, more than 31% diploma holders, almost 18.7% are post-graduate degree holders, and 6.4% are non-graduate.

4.1 Exploratory Factor Analysis

With this analysis, the researchers was able to reduce 48 items in the research instrument to 28 items. To prepare the data for this and subsequent analyses, data cleaning, test for normality using skewness and kurtosis, sample adequacy and sphericity using Kaiser-Meyer-Olkin (KMO) [42], and Bartlett's test were performed on the data collected. Afterwards, Principal Components Analysis (PCA), based on Varimax orthogonal rotation, was used when performing exploratory factor analysis by the researchers. Following the Kaiser's [42] recommendation, a cut-off point was determined. Additionally, the proper values of the anti-image matrix main diagonal are all above the benchmark of 0.500, suggesting that there is no multi-collinearity issue. As shown in Table 2, the Kaiser-Meyer-Olkin (KMO) test which assesses sample fitness is adequate 0.888; also, the values obtained from Bartlett test of Sphericity ($X^2 = 4291.623$, $df = 378$, $p\text{-value} = 0.000$) indicate a good correlations between the variables. Similarly, the amount of variance each variable shares with the other variables, as measured by communalities, are not highly compromised, majority of which are above 0.70. After cleaning and ensuring the suitability of the data collected, six factors, as reported in Table 2 below, were extracted and renamed in accordance with variables in the research instrument (questionnaire) and existing literature. These factors explained accumulated variance of 69.60% with eigenvalue greater than 1.0 (4.24, 4.13, 3.20, 2.85, 2.59, and 2.47%).

Table 2. Rotated component matrix

	Factor				
	1	2	3	4	5
Workplace_Spirituality4	0.819				
Workplace_Spirituality3	0.815				
Workplace_Spirituality5	0.790				
Workplace_Spirituality2	0.722				
Workplace_Spirituality7	0.691				
Workplace_Spirituality8	0.633				
Reward_Recognition2		0.863			
Reward_Recognition3		0.838			
Reward_Recognition1		0.805			
Reward_Recognition5		0.779			
Reward_Recognition4		0.773			
Digital_Capability3			0.812		
Digital_Capability2			0.774		
Digital_Capability4			0.774		
Digital_Capability5			0.726		
Engagement1				0.763	
Engagement3				0.701	
Engagement2				0.675	
Engagement9				0.615	
Engagement8				0.593	
Training2					0.813
Training3					0.774
Training4					0.565
Training1					0.537
Training5					0.504
Job_Satisfaction1					
Job_Satisfaction3					
Job_Satisfaction2					

4.2 Confirmatory Factor Analysis

In addition to exploratory factor analysis, Confirmatory Factor Analysis (CFA) was performed to assess and develop measurement model to specify how well the measured variables come together to represent latent variables (i.e. constructs). All the six latent variables generated during the exploratory factor analysis are retained after CFA; and none of the observed (items) was eliminated during this analysis. While carrying out this analysis, the initial model failed to meet the model fit criteria; as a result, model improvement was embarked upon using modification indices. As such, some of the errors were covariate, since it is likely for the measurement variables that are associated with correlated error terms to share something in common, according to Ho [41]. Upon

model improvement, the model indices (Comparative Fit Index (CFI), relative Chi-square, Root Mean Square Error of Approximation (RMSEA), and incremental fit index) suggest that model fit criteria are met. Figure 2 below presents the outcome of CFA. Moreover, other measures, such as Construct Reliability (CR), Average Variance Extracted (AVE), convergent and divergent validities, and common methods bias, are also conducted and none of them violated existing protocol and benchmark.

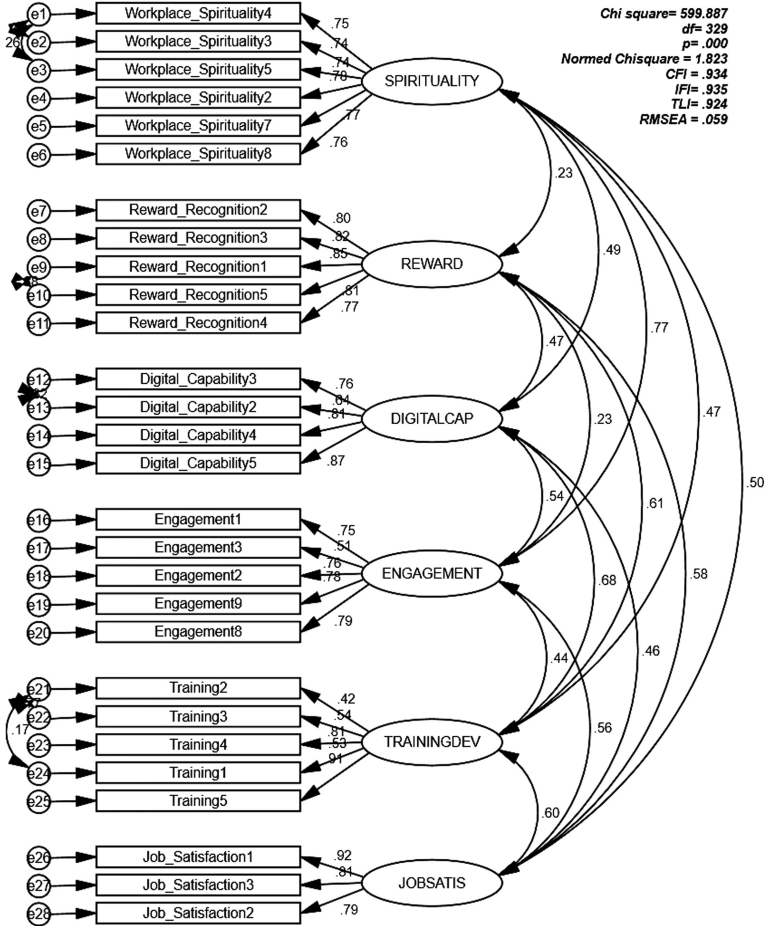


Fig. 2. Measurement model (confirmatory factor analysis)

4.3 Structural Equation Modelling (SEM)

Structural equation modelling was performed to determine the relationships between variables (training and development and employee engagement, digital capability and

employee engagement, workplace spirituality and employee engagement, and reward and recognition and employee engagement). As shown in Table 3 and Fig. 3, digital capability ($\beta = 0.168, p < 0.05$), workplace spirituality ($\beta = 0.737, p < 0.05$), are positively and significantly related to employee engagement. Whereas, training and development ($\beta = -0.081, p > 0.05$) and reward and recognition ($\beta = -0.011, p > 0.05$) are negatively and insignificantly related to employee engagement. The findings indicate that digital capability and workplace spirituality are important contributors to employee engagement in the healthcare sector.

Table 3. Regression weights

	Estimate	S.E.	C.R.	P
ENGAGEMENT ← TRAININGDEV	-0.081	0.074	-1.095	0.274
ENGAGEMENT ← DIGITALCAP	0.168	0.036	4.706	***
ENGAGEMENT ← SPIRITUALITY	0.737	0.041	17.958	***
ENGAGEMENT ← REWARD	-0.011	0.023	-0.488	0.625

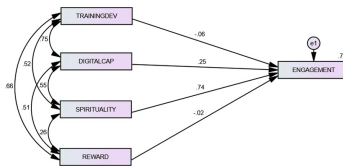


Fig. 3. Structural model

4.4 Mediating Effect (Job Satisfaction)

One of the preconditions when testing mediating effect on the relationships between variables is that such relationships should be significant. As such, the focus here are on the relationships between digital capability and employee engagement, as well as between workplace spirituality and employee engagement when job satisfaction was introduced as mediating variables. Recently, we have reported that these relationships are significant. Therefore, the results of mediating effect of job satisfaction show that the relationships between these variables are partially mediated, since the relationship between digital capability and employee engagement, and between workplace spirituality and employee engagement are still positive and significant. Meanwhile, training and development, workplace spirituality, and reward and recognition are all positively and significantly related to job satisfaction. In addition, job satisfaction is positively and significantly related to employee engagement. These findings are presented in Fig. 4 and Table 4 below.

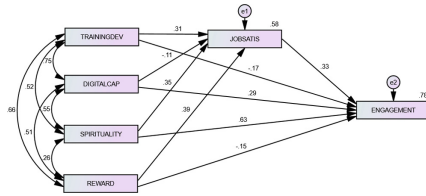


Fig. 4. Testing job satisfaction as a mediator digital capability and employee engagement, and between workplace spirituality and employee engagement

Table 4. Regression weights

	Estimate	S.E.	C.R.	P
JOBSATIS ← TRAININGDEV	0.769	0.187	4.102	***
JOBSATIS ← DIGITALCAP	-0.152	0.090	-1.684	0.092
JOBSATIS ← SPIRITUALITY	0.698	0.104	6.723	***
JOBSATIS ← REWARD	0.403	0.058	6.903	***
ENGAGEMENT ← TRAININGDEV	-0.209	0.070	-3.003	0.003
ENGAGEMENT ← DIGITALCAP	0.194	0.033	5.933	***
ENGAGEMENT ← SPIRITUALITY	0.621	0.041	15.268	***
ENGAGEMENT ← REWARD	-0.078	0.023	-3.409	***
ENGAGEMENT ← JOBSATIS	0.166	0.023	7.095	***

5 Discussion and Conclusion

This study validates the employee engagement framework on the impact of training and development, digital capability, workplace spirituality, and reward and recognition on the employee engagement in the Saudi Arabian public healthcare. It also investigate the above relationships when job satisfaction was introduced as mediating variable. The result shows that digital capability is positively and significantly related to employee engagement in the healthcare sector in Saudi Arabia. This finding supports the argument that organization with right strategies on digital capabilities would perform better and have more engaged employees than their counterpart [22]. Similarly, it was also found that workplace spirituality is positively and significantly related to employee engagement in the healthcare sector in Saudi Arabia. This result supports the study of Saks [4] and Kinjerski and Skrypnek [23].

However, it was also found that training and development and reward and recognition are negatively and significantly related to employee engagement in the health-care sector. These findings contradict the findings of Sendawula et al. [20] but contradicts the fining of Cooper-Thomas et al. [27]. Besides, job satisfaction partially mediate the relationship between digital capability and employee engagement, as well as the relationship between workplace spirituality and employee engagement. Based on the above findings, the researchers have failed to reject two out of the stated hypotheses

that digital capability is positively associated with employee engagement, and that workplace spirituality is positively associated with employee engagement. Whereas, other two hypotheses are rejected: training and development is positively associated with employee engagement, reward and recognition is positively associated with employee engagement. We can also conclude that job satisfaction mediate only the relationship between digital capability and employee engagement, and the relationship between workplace spirituality and employee engagement. Overall, this study has validated the employee engagement framework on the impact of training and development, digital capability, workplace spirituality, and reward and recognition on the employee engagement in the Saudi Arabian public healthcare.

References

1. Lowe, G.: How employee engagement matters for hospital performance. *Healthc. Q.* **15**(2), 29–39 (2012)
2. Wiley, J.W., Kowske, B.J., Herman, A.E.: Developing and validating a global measure of employee engagement. In: *Handbook of Employee Engagement: Perspectives, Research, Issues and Practice*, pp. 351–363. Edward Elgar Publishing Limited, Cheltenham (2010)
3. Hamerman, P.D., Schooley, C.: The Digital Employee Experience Drives Engagement and Productivity. *For. Res. Inc. Cam.* (2017)
4. Saks, A.M.: Workplace spirituality and employee engagement. *J. Manag. Spirit. Relig.* **8**(4), 317–340 (2011)
5. Caldwell, M.: *Employee Engagement and the Transformation of the Health Care Industry*. Towers Watson, London (2011)
6. Imandin, L., Bisschoff, C., Botha, C.: A model to measure employee engagement. *Probl. Perspect. Manag.* **12**(4), 520–532 (2014)
7. Witemeyer, H.A.: *Employee Engagement Construct and Instrument Validation*. Georgia State University (2013)
8. Nienaber, H., Martins, N.: Validating a scale measuring engagement in a South African context. *J. Contemp. Manag.* **12**, 401–425 (2015)
9. Right Management: *Employee engagement: maximizing organizational performance*. Right Manag. (2013)
10. Men, L.R.: Employee engagement in relation to employee-organization relationships and internal reputation: effects of leadership communication. *J. Public Relat.* **9**, 1942–4604 (2015)
11. Shuck, B., Twyford, D., Reio, T.G., Shuck, A.: Human resource development practices and employee engagement: examining the connection with employee turnover intentions. *Brad. Comput. Complex.* **2**(1), 1–9 (2014)
12. Devendhiran, S., Wesley, J.R.: Spirituality at work: enhancing levels of employee engagement. *Dev. Learn. Organ. Int. J.* **31**(5), 9–13 (2017)
13. Vorina, A., Simonič, M., Vlasova, M.: An analysis of the relationship between job satisfaction and employee engagement. *Econ. Themes.* **55**(2), 243–262 (2017)
14. Presbitero, A.: How do changes in human resource management practices influence employee engagement? A longitudinal study in a hotel chain in the Philippines. *J. Hum. Resour. Hosp. Tour.* **16**(1), 56–70 (2017)
15. Rana, S.: High-involvement work practices and employee engagement. *Hum. Resour. Dev. Int.* **18**(3), 308–316 (2015)

16. Saks, A.M.: Antecedents and consequences of employee engagement. *J. Manag. Psychol.* **21** (7), 600–619 (2006)
17. Azeem, M.F., Paracha, A.T.: Connecting training and development with employee engagement: how does it matter? *World Appl. Sci. J.* **28**(5), 696–703 (2013)
18. Nawaz, M.S., Hassan, M., Hassan, S., Shaukat, S., Asadullah, M.A.: Impact of employee training and empowerment on employee creativity through employee engagement: empirical evidence from the manufacturing sector of Pakistan. *Middle-East. J. Sci. Res.* **19**(4), 593–601 (2014)
19. Elnaga, A., Imran, A.: The effect of training on employee performance. *Eur. J. Bus. Manag.* **5**(4), 137–147 (2013)
20. Sendawula, K., Kimuli, S.N., Bananuka, J., Muganga, G.N.: Training, employee engagement and employee performance: evidence from Uganda's health sector. *Cogent Bus. Manag.* **5**(1), 1–12 (2018)
21. Developing digital literacies. <https://www.jisc.ac.uk/guides/developing-digital-literacies>. Accessed 5 Dec 2018
22. Colbert, A., Yee, N., George, G.: The digital workforce and the workplace of the future. *Acad. Manag. J.* **59**(3), 731–739 (2016)
23. Kinjerski, V.M., Skrypnik, B.J.: Defining spirit at work: finding common ground. *J. Organ. Chang. Manag.* **17**(1), 26–42 (2004)
24. Truss, C., Delbridge, R., Alfes, K., Shantz, A., Soane, E.: *Employee Engagement in Theory and Practice*. Routledge, Taylor & Francis Group, London (2014)
25. Soliman, M., Wahba, M.S.: Investigating influencers of employee engagement in travel agents in Egypt. *Anatoli* 1–15 (2018)
26. Taneja, S., Sewell, S.S., Odom, R.Y.: A culture of employee engagement: a strategic perspective for global managers. *J. Bus. Strat.* **36**(3), 46–56 (2015)
27. Cooper-Thomas, H.D., Xu, J., Saks, A.M.: The differential value of resources in predicting employee engagement. *J. Manag. Psychol.* JMP-12-2017-0449 (2018)
28. Abraham, S.: Development of employee engagement programme on the basis of employee satisfaction survey. *J. Econ. Dev. Manag. IT Financ. Mark.* **4**(1), 27–37 (2012)
29. Abu-Shamaa, R., Al-Rabayah, W.A., Khasawneh, R.T.: The effect of job satisfaction and work engagement on organizational commitment. *J. Appl. Bus. Res.* **15**(4), 7–27 (2015)
30. The Economist Intelligence Unit: *Healthcare in Saudi Arabia Increasing Capacity, Improving Quality?* (2014)
31. Collins, K.M.T., Onwuegbuzie, A.J., Jiao, Q.G.: Prevalence of mixed-methods sampling designs in social science research. *Eval. Res. Educ.* **19**(2), 83–101 (2006)
32. Teddlie, C., Yu, F.: Mixed methods sampling: a typology with examples. *J. Mix. Methods Res.* **1**(1), 77–100 (2007)
33. Bakalikwira, L., Bananuka, J., Kigongo, T.K., Musimenta, D., Mukyala, V.: Accountability in the public health care systems: a developing economy perspective. *Cogent. Bus. Manag.* **57**(1), 1–14 (2017)
34. Imperatori, B.: *Engagement and Disengagement at Work: Drivers and Organizational Practices to Sustain Employee Passion and Performance*. Springer International Publishing, Cham (2017)
35. Rurkkhum, S., Bartlett, K.R.: The relationship between employee engagement and organizational citizenship behaviour in Thailand. *Hum. Resour. Dev. Int.* **15**(2), 157–174 (2012)
36. Kim-soon, N.: *Employee Engagement and Job Satisfaction* (2015)
37. JISC: Building digital capabilities: the six elements defined. <https://www.jisc.ac.uk/rd/projects/building-digital-capability> (2016)

38. Sheng, C.-W.: Workplace spirituality scale design - the view of oriental culture. *Bus. Manag. Res.* **1**(2), 46–62 (2012)
39. Turkyilmaz, A., Akman, G., Ozkan, C., Pastuszak, Z.: Empirical study of public sector employee loyalty and satisfaction. *Ind. Manag. Data Syst.* **111**(5), 675–696 (2011)
40. Bulkapuram, S.G., Wundavalli, L., Avula, K.S., Reddy, T.K.: Employee engagement and its relation to hospital performance in a tertiary care teaching hospital. *J. Hosp. Adm.* **4**(1), 48–56 (2015)
41. Ho, R.: *Handbook of Univariate and Multivariate Data Analysis and Interpretation with SPSS*. Chapman and Hall/CRC and Taylor & Francis Group 6000 (2006)
42. Kaiser, H.F.: The application of electronic computers to factor analysis. *Educ. Psychol. Meas.* **XX**(1), 141–151 (1960)



Proposal for Empowering Teams for the Purpose of Identification of Deviations and Elimination of Accidents

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Abstract. The present work suggests that the empowerment of each employee, making them sufficiently responsible, aware and with the capacity and authority to act on the deviations, will cause the risk management to achieve the desired results. Also discussed in this paper is the fact that, by placing the employee in a position to act with authority, there is, on his part, a vertical upward displacement along the Maslow pyramid. Therefore, it is observed that, as the employee ascends the scale, he begins to behave more actively, moving vertically downwards in the accident prevention pyramid, passing as a passive actor, at the risk of undergo an accident, to an attentive agent in the identification of deviations and acting on them, avoiding the evolution of the events along the sequence deviation, incident, near-accident, non-serious accident, serious accident. conditions before companies can efficiently collaborate in investigations.

Keywords: Employee empowerment · Maslow pyramid ·
Accident events reduction

1 Human Factors and Their Impacts on the Investigation of Occupational Accidents

Workplace activities involve risks that may be inherent to the task developed or introduced by worker behaviors. These behaviors developed consciously or unconsciously expose the employee and other company employees to accidents.

The definition of occupational accidents has undergone transformations throughout the years being associated from events led by deities to events arising of exclusively natural causes. With industrialization and incorporation of technologies, the typology of accidents was modified, and the accident rate began to present itself intensely.

Accident as a multifactorial event, social and organizational factors should be considered in its evaluation [1].

The increasing demands for high productivity often lead the employee to a stressful situation requiring him to take a stand and actions for which, often, the worker may not be sufficiently prepared in several aspects including: physical, emotional and capacity building.

Employee performance is influenced by many factors such as: physical, work, organizational and social. These factors can lead to feelings of dissatisfaction, fear, anguish, unhappiness, with effect on the physical and mental health of the worker.

In a more comprehensive view, the origin of accidents is related to the strategic decisions adopted by top management [2], type of adopted technology [3], existence of operational and safety procedures, training adequacy and frequency, relationship with the community, compliance with the legislation to which it is linked, among others.

In this context, human failure as the cause of accidents is not to be considered the sole fault of the worker, in a simplistic analysis, without a detailed evaluation of the whole chain of events that triggered the accident. Despite the evolution of accident investigations and theories about the causes of accidents, the position adopted by companies can still be observed, favoring the idea that accidents originate from employee actions or omissions, resulting from the psychological aspects of employees, as results of free and conscious choices.

Human factors have a decisive influence on the actions of employees at all hierarchical levels, in their work environments, defining interactions with each other, with equipment and facilities, as well as with the management system adopted by the company, extrapolating the physical boundaries of the organization, influencing and being influenced by society. Human factors can be considered a set of environmental, organizational and work factors, and the individual and human characteristics that influence the behavior in the workplace, being able to affect health and safety.

Such factors should be considered by the company as one way to provide better results of the interaction between people and their activities, aiming at the efficiency of the system, security and well-being of the individual [4].

The employee is an integral and interdependent part of the production system and should be considered the company's human capital [5]. Due to this situation, organizations must continually seek to improve working conditions and employee satisfaction, which in principle and in the short term may represent a cost, in the medium and long term can result in behavioral gains, security and financial management.

2 Motivation, Accident Prevention and Cost Models

In 1943 researcher Maslow [6] proposed that each individual presents a set of needs to achieve satisfaction, whether personal, social or professional, and these needs, according to the motivational theory, are the psychological factors that drive actions. According to Maslow, needs can be hierarchized into five overlapping levels, characterizing a pyramid-shaped figure, usually called Maslow's Pyramid or Maslow's Hierarchy of Needs (Fig. 1). For Maslow [6], each individual is motivated to seek to maintain, reach or supplant basic needs, also desiring intellectual and social ascension.

As stated by Maslow [6], each individual is motivated to maintain, reach or supplant basic needs, also desiring intellectual and social ascension.

The needs in ascending order are: physiological, safety, social, esteem and those of self-realization, being complementary, but mutually excluding. This theory proposes that human beings seek to satisfy specific needs, these needs being the motivational factor of the actions of individuals.

Physiological needs, which correspond to a primary need, are located at the base of the pyramid, being present in all individuals, and their satiety does not generally require high criteria or requirements on the part of the claimant. We can describe in this category physiological, sexual and other needs.

The aspects associated with financial stability, job stability or even insurance against street violence correspond to Safety needs, which are at a level just above the physiological needs. Although classified as a secondary need, the need for safety is as important as the primary need.

Social needs are intended to establish harmonious human relations with harmony. The individual seeks to feel part of a group, to be a member of a club, to receive attention, consideration and affection of other members of the social group.

The level immediately above social needs correspond to another secondary need, called the need for esteem, for which there are two types: the recognition of our abilities and the recognition of the individual by others. At this level are the needs to feel dignified, respected by you and by others, prestige, proud and with self-esteem.

At the top of the pyramid lies the need for self-actualization that presents the highest complexity, requiring, therefore, an immense effort to be achieved.

Not only do needs contribute, but personal factors, as well as physical and economic conditions, among others, determine how, why, and how much individual will move between levels of the pyramid [7].

Thus, individuals act to meet their needs and, once this need is fulfilled, they will no longer be motivated by it until it returns to manifest itself. The motivation of each individual, according to Maslow [6], is directed to the lowest level of need if there are simultaneous demands of different levels. The transition from one level to the next will occur when the need for the lowest order is met.

Critics of Maslow's work point out that the harmonization and implementation of organizational and operational actions to meet the needs presents a reasonable challenge to companies. Also, due to the inherent difference in behavior of individuals, organizations may find it difficult to meet very specific demand, and this situation, if not adequately addressed, is a potential demotivation factor.

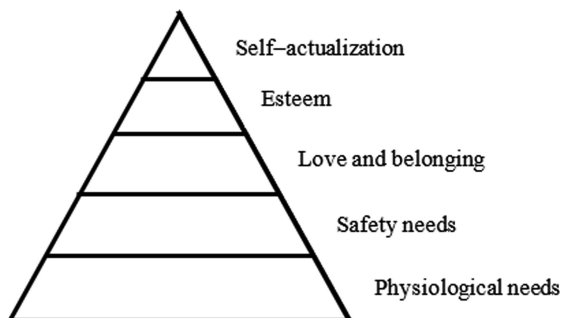


Fig. 1. Maslow's pyramids of needs.

Throughout the years of 1930 and 1960 several were the studies and statistical. Between 1930 and 1960 there were several studies and statistical surveys on the accidents occurred in companies. Researchers Heinrich [8], and Bird [9] stand out due to the representativeness of their work. The study by Heinrich [8], based on more than 75,000 accident reports, found that for approximately 300 unproven injuries, there were 29 mild injuries and one disabling injury. The graphical representation of this relation originated the figure called Heirinch pyramid (Fig. 2).

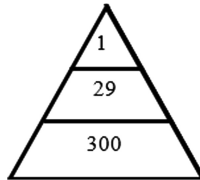


Fig. 2. Heinrich's pyramids of accidents.

These results indicate that actions aimed at reducing the number of accidents should be directed at prevention, rather than events that result in incapacitating or fatal injuries. For Heinrich [8], the main cause of accidents is human error, becoming the focus of accident prevention. However, Heinrich [8] did not consider physiological factors (malnutrition, diseases, etc.), organizational (excessive pressure, long working hours, lack of training, etc.) or ergonomic (lighting, ventilation, etc.).

In the 1960s, Bird [9] analyzed events in about 300 companies, encompassing more than 1.75 million employees and, similarly to Heinrich [8], the 600:30:10:1 ratio correlates 600 incidents for every 30 accidents with material damages, for every 10 minor personal injuries and for one fatal, severe or incapacitating accident. Using the same graphing form, the results of Bird [9] resulted in the creation of the Bird Pyramid (Fig. 3). It is worth noting that Bird [9] expanded the database by covering in the analysis the events that included damages to the patrimony or to the environment.

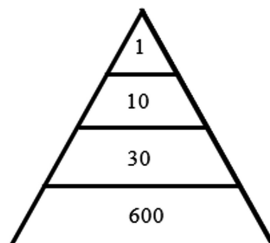


Fig. 3. Bird's pyramids of accidents.

More recent studies by ConocoPhillips Marine [10] propose a change in the proportion and constitution of the Bird Pyramid [9]. Deviations from activities began to be considered, composing the lowest level of the pyramid, while the ratio of events to 300,000:3000:30:30:1, which correlates 300,000 deviations for every 3000 incidents for every 300 accidents involving material damages, for every 30 minor personal injuries and for one fatal, serious or incapacitating accident (Fig. 4).

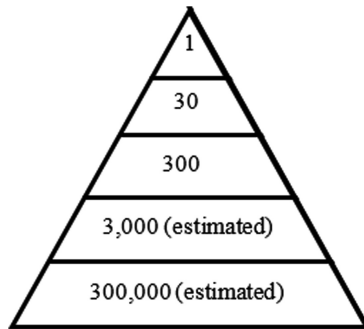


Fig. 4. ConocoPhillips Marine pyramids of accidents [10]

Estimating the cost of accidents is often a sensitive issue for companies. The information is difficult to obtain, and the quantification of losses represents, in some cases, a great challenge to overcome. The values included in the cost pyramid were estimated considering a few accidents that involved fatalities in Brazil (Fig. 5). Aspects such as disability or death compensation, fines, loss of profits, devaluation of shares in stock exchanges, remediation of environmental impacts, compromise of the company’s image make up the estimated costs [11–14]. Legislation, whether international, national or local, also contributes significantly to costs.

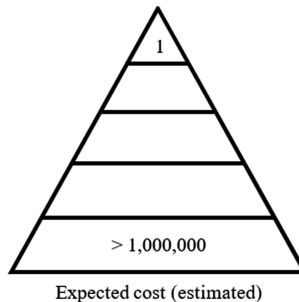


Fig. 5. Pyramids of expected cost.

3 Methodology

The work was developed through a bibliographical research of the models of Maslow [6], Heinrich [8] and Bird [9], analyzing their structures, seeking to identify correlations between them, in order to elaborate an integrated model.

For the collection of the data of the experts' perception, semi-structured interviews were carried out with six professionals in the area of risk management, working in chemical and oil companies from various regions of Brazil.

Professional experience in the area of risk analysis and management of each interviewee exceeds 15 years of work in companies considered to be high risk due to working in severe process conditions such as high pressures, production, handling and storage of toxic or flammable substances.

The objective of the interviews was to know the perception of the practice of these professionals regarding deviations, incidents and accidents, seeking to correlate the motivational conditions, with the actions of accident prevention and estimate the costs resulting from deviations, incidents and accidents.

The data obtained in the interviews were confronted with the models of Maslow [6], Heinrich [8], Bird [9] and ConocoPhillips Marine [10]. In a subsequent step, a model of integrated representation of the motivational characteristics, the relationship between deviations, incidents and accidents, as well as of the tangible and intangible costs incurred, was proposed.

The investigation followed the steps described in Fig. 6.

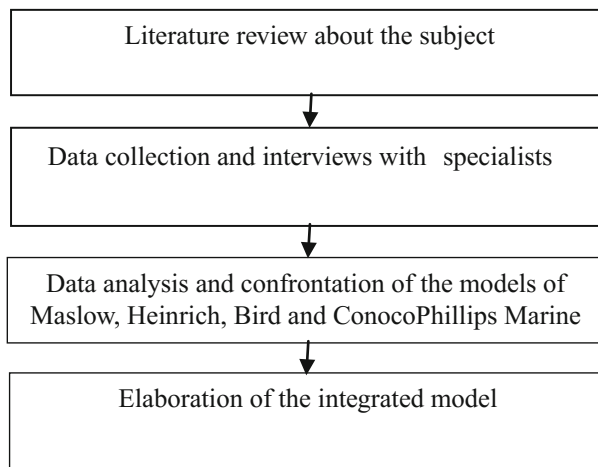


Fig. 6. Methodology steps

4 Analysis and Discussion of Results

Employees are key players in accident prevention because they are generally closer to sources of risk. Delegating authority and autonomy to question and propose improvements in working conditions can be an efficient tool in reducing accidents. In order to do so, it is necessary that the employee be trained continuously in the identification of possible risks and in the evaluation of the consequences, as well as their empowerment so that he can carry out these preventive actions without fear of intimidation, but with the possibility of being contested. If the employee takes an inappropriate attitude towards his/her action, this situation should be transformed into learning experience.

From this perspective, the integrated model of Maslow’s pyramid of needs, ConocoPhillips Marine pyramid of accidents prevention [10] and the pyramid of cost expectations are presented, according to Fig. 7.

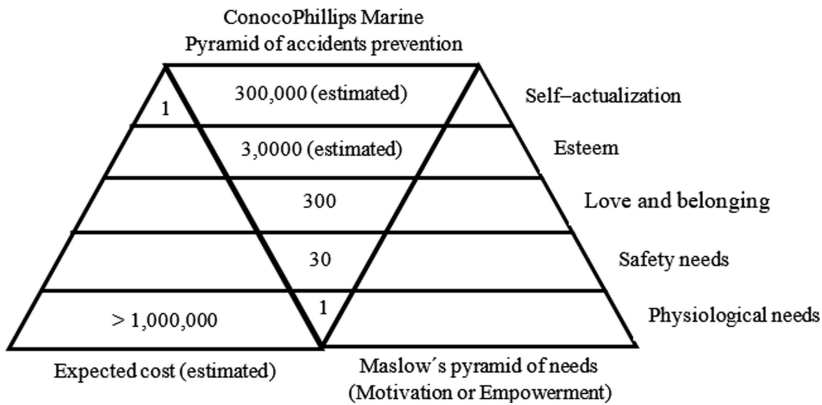


Fig. 7. Integrated model

In the integrated model the pyramid of accident prevention is presented in inverted position, between the pyramid of Maslow and the pyramid of expectation of costs, so that each level of the pyramids is correlated.

The model proposes that when the employee is in the lower levels of the Maslow pyramid, he may not be adequately motivated to seek the identification of deviations, allowing the sequence of potentially accident-causing events not to be interrupted. In this condition, an accident with permanent or fatal injury is more likely to occur, corresponding to a high cost, both financial and social, in relation to the company’s image, among other factors.

Still in this perspective, numerous accidents have occurred due to the inadequate conditioning of the employee’s physical health or inappropriate emotional situations when he is required to perform his work activities under pressure from the company. The generation of an environment where the employee can position himself, be

evaluated and understood without representing a penalty possibility or other negative consequence, favors the reduction of accidents.

Employee empowerment enables the employee to move up the Maslow pyramid, reaching the highest levels, and acting more effectively in order to identify and act on the deviations.

Earnings are expected in terms of accident reduction, costs and damages to the company's image and quantitative and qualitative increases in production. Another possibility are the gains derived from improving the work environment and interpersonal relationships, in a process of continuous and comprehensive evolution.

Continuous training and qualification are important in order to achieve results, especially in relation to the identification of deviations. The content addressed in the training should focus on the characteristics of the activities performed, as well as knowledge regarding job security and processes, as well as in terms of broader subjects, allowing the employee a holistic view of the activities carried out in the company.

5 Conclusion

The integrated model proposes to correlate the levels of Maslow's pyramid of needs, ConocoPhillips Marine pyramids of accidents and the pyramids of expected cost in a perspective of pointing out that as the employee reaches the highest levels of his needs, the more active he will be in preventive terms, acting on deviations in a more effective way, with consequent reduction of accidents and corresponding costs.

The inverted positioning of ConocoPhillips Marine pyramids of accidents allows us to more clearly represent the outcome of motivated employee actions.

References

1. Hoyden, J., Albrechtsen, E., Ivonne, A.: Is there a need for new theories, models and approaches to occupational accidents prevention? *Saf. Sci.* **48**, 950–965 (2010)
2. Reason, J.: Reconciling the different approaches to safety management. In: Reason, J. (ed.) *Managing the Risks of Organizational Accidents*. Ashgate Publishing, Alders (1997)
3. Perrow, C. *Normal Accident: Living with High-Risk Technologies*. Princeton University, New Jersey (1999)
4. Hawkins, F.H.: *Human Factors in Flight*. Ashgate, Aldershot (1993)
5. Moreira, N.C.: *Qualidade de Vida no Trabalho: Um Estudo de Caso na Universidade Federal de Viçosa, Minas Gerais Brasil* (2009)
6. Maslow, A.H.: A Theory of human motivation. *Psychol. Rev.* **50**, 370–396 (1943)
7. Chiavenato, I.: *Introdução à teoria geral de administração*. Elsevier, Rio de Janeiro (2003)
8. Heinrich, W.H.: *Industrial Accident Prevention*, 4th edn. McGraw-Hill Book Company Inc., New York (1959)
9. Bird Jr., F.E., Germain, G.L.: *Practical Loss Control Leadership*. International Loss Control Institute, Georgia, USA (1985)
10. ConocoPhillips Marine: *Safety Pyramid based on a study*, April (2003)

11. G1: Airbus pagará mais de R\$ 30 milhões para grupo de familiares de vítimas de acidente com avião da TAM em Congonhas. <https://g1.globo.com/rj/rio-de-janeiro/noticia/airbus-pagara-mais-de-r-30-milhoes-para-grupo-de-familiares-de-vitimas-de-acidente-com-aviao-da-tam-em-congonhas.ghtml>. Accessed 31 Jan 2019
12. Mato Grosso: Gol vai pagar R\$ 4 milhões a índios de MT por acidente com voo 1907. <http://g1.globo.com/mato-grosso/noticia/2016/11/gol-vai-pagar-r-4-milhoes-indios-de-mt-por-acidente-com-voo-1907.html>. Accessed 31 Jan 2019
13. G1: Itaú estima impacto de R\$ 30 a R\$ 110 bilhões para a Vale com acidente em Brumadinho. <https://g1.globo.com/economia/noticia/2019/01/29/itau-estima-impacto-de-r-30-a-r-110-bilhoes-para-a-vale-com-acidente-em-brumadinho.ghtml>. Accessed 31 Jan 2019
14. Infomoney.com.br: Tragédia da Vale renova polêmica da reforma trabalhista; entenda os trâmites na Justiça. <https://www.infomoney.com.br/vale/noticia/7895330/tragedia-da-vale-renova-polemica-da-reforma-trabalhista-entenda-os-tramites-na-justica>. Accessed 31 Jan 2019



Leader as an Effective Strategy Implementer in Public Higher Education Institutions

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Abstract. The article presents the analysis of the contemporary concepts of a manager as a strategic leader based on the scientific publications and the research conducted in the framework of the research project. The aim of the project was to identify a correlation between a strategy of the educational organizations, its processes and the organizational structure. The role of the leader of the organization as a visionary, initiator and executor of changes was one of the elements which were analysed. The activities were conducted in the research group SYDYN.

Keywords: Leadership · Strategy

1 Introduction

Leadership is the most important factor which decides whether the organization is successful in the rapidly changing environment. What is the role of the leader, how does s/he create a vision and a mission, what example does s/he give, which values does s/he follow, is s/he only a leader or an administrator, does s/he create good conditions for horizontal and vertical communication, does s/he delegate eagerly powers and responsibility and if yes, does s/he still feel as a leader or does s/he only demonstrate a will to implement changes.

Organizations nowadays are influenced by the changeability of the environment both in the legal and socio-economic aspects. Therefore it becomes very important for the managers of the organizations to choose an effective method of management. They must remember that the application of the current management methods requires a sound assessment and a detailed analysis since their application can be both a source of successes and disappointments within the organization [1].

The managers are at the head of each organization. Therefore it becomes reasonable to ask how many of them can be called leaders who are able to implement effectively the defined strategic aims and to carry the organization through the process of turbulent changes.

The area of higher education sector which is analysed in this paper is in the period of transformation which is caused by an introduction of brand new provisions regulating the functioning of higher education institutions in Poland [2]. The legislators in the new legal provisions significantly increase the powers of a rector who manages a

public higher education institution. The legal change implies a creation of new internal regulations which will shape the internal structures of higher education institutions. Nowadays in the field of higher education the intensive works are being conducted which aim is to give anew shape to higher education institutions. The success of the organization will depend on the adopted style of management. Therefore the features of the rector-leader which will ensure the acceptance of activities among the staff members are important. The person leading a higher education institution should work out a mission and a vision of the organization and to convince the staff to them [3] and by means of a strategy to define a unity of aims and the direction of operation of a higher education institution [4]. The higher education institution will be successful if a rector will be able to create and maintain an internal environment in such a way that the members of academic community will fully engage in achieving the successes of the organization.

The paper presents the role which should be played and the features which should be possessed by the leader of the higher education institution in the light of the process of strategic management in order to move the institution towards the development, self-improvement, beating the competitors and achievement of the defined aims [5].

2 Research Method

The research method is based on the detailed analysis of the literature in the field of leadership thanks to which it was possible to analyse the features of the manager playing the role of the leader. The paper presents the role of strategic management in a public higher education institution based on the surveys conducted in national higher education institutions. The analysis and the deepened case study of leadership and the strategic management allowed the authors to formulate the final conclusions.

3 Results of Analysis

3.1 Analysis of Leadership Features

Already in the ancient times it was tried to discover both the exceptional and the typical features in order to be able to select and “appoint” leaders and to shape them [6]. It was considered that the excellent leaders are born as such- they are charismatic and the leadership is a scarce skill. It is necessary to remember about the doubts of P.F. Drucker who states that: “>>manager personality<< or >>the features of the leader<< do not exist (...). The only feature of character which I noticed among all the best leaders without any exception was that they lacked or had very little of charisma” [7]. There are different features which are combined with the charisma of the leader such as: determination, honesty, the knowledge of the branch, desire to be a leader, self-confidence or high intelligence [8]. A thrilling leader should be fair, kind, talented, competent, qualified and decision-making. Furthermore a leader is a friendly person who is able to enter into relations with staff members and to inspire them to hard work. The researchers of this area underline the following features of the leader: enthusiasm,

honesty, being demanding combined with being fair and with human feelings, self-confidence, humility and courage [9].

According to the rule 4E of J. Welch (Energy, Energizer, Edge, Execution) the leader should be characterized by energy, encouragement to act, the jam (determination to achieve aims) and orientation on results [10]. The features which distinguish the real leaders from managers are: charisma, personal example, creation of culture and values, legend, stardom and trust guarantee [11]. According to Ch. Handy the leader who is successful must combine the believe in own strengths with a feeling of the justified doubts and must be the person who loves people but must be able to combine the activities among people with individual work [12, 13]. The emotional intelligence which is shaped by self-awareness, self-control, internal motivation, empathy and social skills [14] make a good leader.

The leaders who lead the organizations should show such features as: global thinking, an appreciation of cultural differentiation and the building of friendly relations. The true leader is able to share the leadership shaping himself a common vision encouraging people to implement it. Aiming at a personal proficiency, s/he encourages to a constructive dialogue between the members of the managed community [15]. The leader is the person who is able to foresee particularly the favourable circumstances which will ensure the clients' satisfaction and maintaining a competitive gain.

The speed and the accuracy of the decisions together with the rationality and consequence in actions are the features of the leader [16]. The effective leader thinks in the long-term and that is why formulates the ambitious aims and wants to achieve them by inspiring others with a common vision. The fact that s/he is a convincing speaker who is willingly listened by others helps him to achieve aims.

The honesty gives him a mandate to assess the activities of the organization and makes him manage the changes which are implied by the changeability of the outer environment of the organization.

While describing the leader the need for closeness expressed in the openness towards people is often underlined. The closeness can be characterized in the following way: "The managers must stop doing the different things for people- they must start doing the things with them" [17]. People in the organizations should be sure that the manager are led by common sense while taking decisions. The rational thinking which makes the commitments done by both parties possible to be implemented are the basic task of a good leadership. The leadership in practice means a consent to change the quality in the life of those who will agree for leaders to lead them [18, 19].

All of the aforementioned skills enters the implementation of the mission of a higher education institution as an organization based on the moral values shaping the young generation and aiming to disseminate science. Simultaneously the managerial features of the rector make him an efficient and effective implementer of the strategy adopted by the higher education institution. The inspiration for people to work in order to implement a common vision and strategy is looked for in the leader [8].

3.2 Strategy in a Public Higher Education Institution

A public higher education institution is supposed to fill in a mission and a vision which should be defined by the leaders and the strategy is the way to implement a mission.

The ambitious and almost crazy strategy stands a chance of being implemented only when the enthusiastic and even fanatic implementers are involved, which requires a high quality of leadership referring to a wide range of motivators, ambitions and emotions [20].

It is a problem of the strategists to formulate a “good” that is an effective strategy of the development of a higher education institution. Its effective implementation is equally important where the effectiveness is understood as the achievement of the defined aims. The effectiveness of the strategy is supported by the application of RUN concept which is the result of the analysis of the features and elements of strategy, particularly in the field of higher education [21]. These are: Reality, Unexpected effect and simultaneously Normal activities. The strategy formulated according to RUN rule should lead an organization towards the self-improvement, obtaining competitive advantage and reacting to changes in the external environment.

In the higher education institution which is a complex community, there are endless individual strategies of operation. In the area of the higher education due to the complexity of the structures the strategy has a cascade character. The general strategy of higher education institution should be supported by coherent strategies of basic organizational units. That is why the role of the rector who can be defined as “the main strategist” becomes so important. His main aim should be rather to point at the activities which should be taken within the organization and outside of it than managing them. The personal features of the rector as the leader of the organization become important together with the knowledge of the rules of strategic management in higher education institutions which can have an influence on the effectiveness of the management process [22].

In order to prevent the failure of the defined strategy in the academic environment one can observe an insurance behaviour of rectors and deans which is visible in the so-called “safe formulation of the strategy”. Defining it as a very general one allows the leaders to prove at the end of the term that it was implemented [23]. In such conditions it is impossible to create the procedures of the strategic management which fulfil the requirement of a higher education institutions and at the same time are looking towards the future [24].

It is known that the strategic management should not have an occasional character or be “action type” [25]. If the strategic management does not lead to the understanding of the environment and the effective positioning of the company, in the changeable times the organization cannot beat the competitors [26].

In the light of the key role which the strategy plays for the organization- the strategy of a higher education institution should be a document which is „alive in the organization” and which is very vital for the organization [21]. Only ensuring a permanent revision of the strategy it stands a chance of becoming a tool which overcomes new, unpredicted challenges thanks to which the organization stands a chance to follow a reality and to come ahead [11, 27].

In the higher education institution, in the aspect of the terms of the rector’s power and the big changeability of the environment, it is important to maintain the continuation of the process of strategic management. The strategy should in its time range go far beyond the horizon of the current authorities being a follower of the vision of predecessors. The rector- leader creating the strategic changes should take into

consideration the changeability of the external environment ensuring at the same time the continuation of activities within the institution. The maintenance of the continuation of strategic activities will ensure the staff member that they are not only the implementers of the vision of people managing the higher education institution in the current term but are also a total vision of the development of the organization.

3.3 The Model of Strategic Management in Public Higher Education Institutions

The analysis of the strategic management in the field of public higher education institutions allows to formulate the following conclusions [21]. The strategy document although it exists in every higher education institution was not created in every case from the internal needs of the managers. In many cases it was imposed by the legal requirements. It is the case because not all the members of the higher education institutions authorities notice the benefits which derive from the possession of the strategy. The strategy is often treated as a theoretical document which does not influence the strategic operational activities. This document is made available for many interested stakeholders but not always to staff members who implement the different activities. The detected lack of the implementation of the strategic aims entails a change of the aim and not the responsibility of the person who supervises. The strategy of the higher education institution is treated more as a business card than a real action plan.

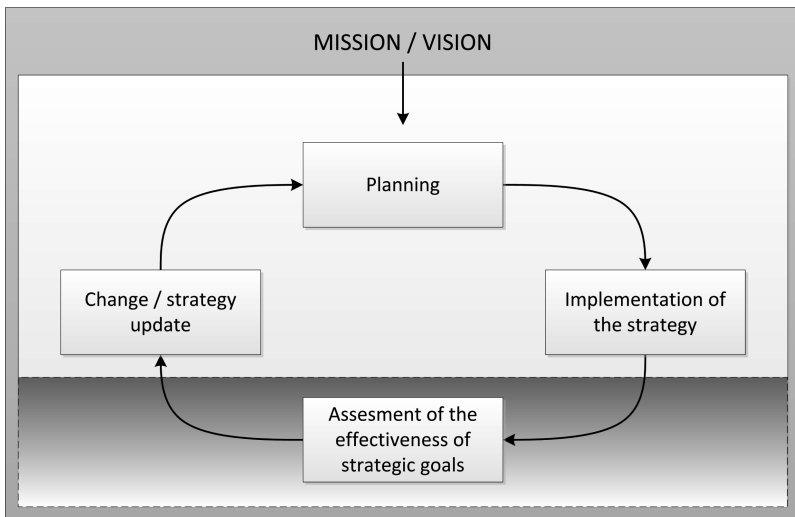


Fig. 1. A strategic management model at public higher education institutions. Source: [21]

Taking into account the features of an effective and efficient strategy and the imperfection of the management process in this area in public higher education

institutions in Poland a model of the strategic management adjusted to the sector of public higher education institutions was proposed and it is presented in Fig. 1.

The mission and vision of the higher education institutions are the starting point and they should be changed into real strategic aims which can be implemented. The planning stage should take into account the visionary aims of the higher education institution and the mission which it is to fulfil as a public organization. The strategy implementation should be supported by all the activities which increase the effectiveness of the implementation and realization. The picture which emerges from the research on the implementation of the strategy in public higher education institutions gives the basis to state that the support mechanism do not work. The public higher education institutions did not implement the elements which allow the reliable assessment and that is why the stage of the evaluation of the strategic aims is not also an element which supports the implementation of the strategy.

The distortion in the process of planning, implementation of the evaluation and the changes in the strategy make this process not stable and not continuous. The strategic management does not guarantee an effective implementation of the strategic aims, their reliable assessment or the real repair actions [28].

3.4 Features of the Leader in the Aspect of Strategy Implementation

The aforementioned analysis provides a set of features which a leader should possess in order to make the process of the strategic management in the organization s/he manages effective and efficient one (Table 1).

Table 1. Elements of strategic management in the field of higher education and their corresponding features of the leader - strategist

Strategic management stage	Features of the strategist	Features of the leader
Creation of the mission/vision of higher education institutions	Vision Long-term thinking Looking to the future Prediction	Desire to be a leader Charisma Creativity Innovation Appreciation of differences Vision Creating a culture of value Legend, stardom Aptitude
Planning	Risk analysis Prediction Being an expert Global thinking	Confidence Enthusiasm Courage Competence Qualifications Ambition

(continued)

Table 1. (continued)

Strategic management stage	Features of the strategist	Features of the leader
Strategy implementation	The ability to involve others Stimulation to action Determination in pursuit of goals Sharing leadership Developing people's potential	Energy Vitality Enthusiasm Constructive dialogue Communication Openness to people Inspiration for people Friendliness The easiness of establishing contacts Communication Trust guarantee Kindness Empathy
Evaluation of the implementation of strategic goals	Constructiveness Consistency in action Focus on the result	Honesty Justice Regularity Being demanding Self-control
Changes, strategy update	Leading changes Maintaining competitive gain over competitors Reaction to the factors inside the organization Reaction to the changes in external environment	Ability to foresee Speed of taking decisions Courage Taking decisions Flexibility Humility

Source: Own preparation

The leadership refers to “soft” issues: social, cultural and even emotional and is greatly based on the personal features. The leadership skills can be developed but certainly they cannot be learnt.

3.5 Features of the Leader as a Strategist - the Managerial and Characterological Dimension

The roles of the leaders have special, elite character and the set of features which are not common and which are personal is the criteria of belonging to this group. The different leadership attitudes were distinguished based on the different attitudes of the authority [29]. The power based on identification, knowledge and skills suits the role of the leader. The referent power is based on the perception of personal skills of the superior as attractive which give a willingness to be influenced by them. Such a form of the leadership is able to cause admiration for the leader personality among the staff

members. The appreciation among the staff members is caused by the fact that the leader is a convincing person and can have influence on the subordinates. Thanks to the members of the organization and with their participation the leader can implement the defined aims for the organization included in the strategy document. Also the expert power is a kind of expert knowledge based on the knowledge and skills of the leader thanks to which we treat a superior as a person who has more power. The subordinates try to behave in such a way as to follow the expert. The higher the level of knowledge of the subordinate in the given area, the stronger the basis for power. For this reason the rector which manages the higher education institution should show the knowledge and management skills. His voice should be the expert voice which besides the features of the character which predestine him to lead an organization is also driven by professionalism and methodology from the area of strategic management. The leader should not be characterized by the legitimate power, reward power or coercive power. These attitudes of power are based on the autocratic way of management based only on formal dependencies in the organization reflected in the formal hierarchy. The impact on other people by giving orders, awards or punishments is a sort of the power where the fear is the central element. By using the hierarchical control, the possibility of achieving the organization goals diminishes [18].

The leader-strategist cannot punish for non-conformist behaviour by dismissing somebody, decreasing the salary or moving to a different position. The authenticity of the leader will not survive the test of time if his attitude is based on evoking negative emotions in his subordinates.

4 Summary

Managing a group of people is not only a challenge but also a great responsibility. The leader should possess not only the knowledge and the understanding of the management and motivation methods but should be close to people becoming their supportive friend. The higher education institution is supposed to fulfill a mission and a vision which should be defined by the leaders whereas the strategy is a way to implement the mission. The ambitious strategy can be implemented if one manages to attract enthusiastic followers, which requires a high quality of the leadership referring to a wide range of motives, ambitions, emotions [20]. The leadership should be embodied in a charismatic person able to give to subordinates clear and energizing statements, looking after mobilization and providing a personal example.

Besides the responsibility for indicators, aims, parameters and final financial results of the company, it is important for the leaders to support the concepts of people as individuals [19]. The management of human resources should include some empathy and understanding of people differences. Therefore, a good leader is the one who can distribute the tasks in such a way in which the talents and skills of people in the organization are fully used. What is more the leader should have the features which allow everybody in the organization to have their own input in the implementation of aims providing each person with a possibility to develop and to self-realize.

The leader is responsible not only for the current status of the organization but looking far-away should be able to identify and enable the development of the future

leaders. The leadership is the thinking of the organization in the category of commitments contrary to the way of management perceived as a possession. This kind of leadership is called service [30]. The leaders, leading particularly higher education institutions must leave behind durable values and heritage. The leader of the higher education institution should be able to cultivate the tradition from which they derive together with values and the organizational culture. Simultaneously, taking care of the organization development, thanks to the effectiveness of the undertaken actions, the leader is able to take the higher education institution through the period of the legal changeability, staff fluctuation, economic trends and fight for clients.

Many staff members think it is enough to work properly in the given position. They often do some work because a different staff member waits for their product or a service, which must meet their expectations in the creation of the chain value. If somebody does the job badly, somebody else will have to report it or correct it which will slow down the cycle and as the effect the whole organization will lose.

The observations showed that many people in organizations leave in their small world, separated from other worlds by a wall “as long as I do what I am told to do it is ok”. While working on the diagnose, many leaders realized that the problems in their small worlds derive from the lack of understanding of the role their process plays in the whole organizational system. Each process, even the smallest one, is an important element of the chain value. The chain is as resistant as the weakest part of it. Everybody is important. Every manager, leader creates the environment and causes that the value in the synergy system is created. In the reality there are no small worlds, there is one world of the organization, in which every part of it is a part of the success. How can the employees know in which direction they should go and what are the priorities in actions? The leaders take care of it. It is impossible to overestimate the role of the leader.

If the leader is only the administrator, so consciously gives up the role of the leader, s/he does not want, cannot or is not able to point at such methods of actions when everybody is proud of their work.

References

1. Penc, J.: Nowe koncepcje zarządzania. *Ekonomika i Organizacja Przedsiębiorstw* 7 (2002)
2. Ustawa 2.0: “Prawo o szkolnictwie wyższym” (2018)
3. Mroczko, F.: Zarządzanie Jakością. *Prace Naukowe Walbrzyskiej Wyższej Szkoły Zarządzania i Przedsiębiorczości*, Walbrzych (2012)
4. Norma ISO 9000:2015: Podstawy i terminologia (2015)
5. Matejun, M., Szczepanzyk, M.: Strategic determinants of the use of development-support instruments in the management of SMEs. *Mediterr. J. Soc. Sci.* **4**, 479–490 (2013)
6. Ledeen, M.A.: Machiavelli. *Nowoczesne przywództwo*. Helion, Gliwice (2006)
7. Drucker, P.F.: *Management, Tasks, Responsibilities, Practices*. U.S ed. Harper & Row (1974)
8. Avery, G.: *Przywództwo w organizacji. Paradygmaty i studia przypadków*. Polskie Wydawnictwo Ekonomiczne, Warszawa (2009)
9. Adler, N.J.: *Leadership Insight*. Taylor & Francis Ltd., New Jersey (2010)
10. Krames, J.A.: *Jacka Welcha leksykon przywództwa*. Studio EMKA, Warszawa (2003)

11. Kozminski, A.K., Jemielniak, D.: *Zarządzanie od podstaw. Podrecznik akademicki*. Wydawnictwo Akademickie i Profesjonalne, Warszawa (2008)
12. Handy, C.: *Glod ducha: Poza kapitalizm. Poszukiwanie sensu w nowoczesnym świecie*. Poza Horyzont, Warszawa (1998)
13. Stankiewicz-Mroz, A.: Factors building commitment of healthcare workers. *Adv. Intell. Sys. Comput.* **779**, 149–158 (2019)
14. Goleman, D.: *Inteligencja emocjonalna. Media Rodzina*, Poznan (2005)
15. Goldsmith, M.: *Globalni liderzy-kolejna generacja*. MT Biznes, Warszawa (2007)
16. Atamanczuk, K.: *Jednoska, grupa, przywództwo w teorii i praktyce zarządzania*. Olsztyńska Wyższa Szkoła Zarządzania im. prof. T. Kotarbinskiego, Olsztyn (2000)
17. Dzwigol, H.: Menedżerowie przyszłości a zarządzanie strategiczne. *Zeszyty Naukowe Politechniki Śląskiej* **70**, 93–104 (2015)
18. De Pree, M.: *Przywództwo jest sztuka*. Business Press, Warszawa (1999)
19. Matejun, M.: The process of opportunities exploration and exploitation in the development of SMES' innovativeness. *Manag. Prod. Eng. Review* **9**, 3–15 (2018)
20. Fertsch, M., Grzybowska, K., Stachowiak, A.: *Zarządzanie: zasoby, ich dobor i sposoby wykorzystania*. Politechnika Poznańska. Instytut Inżynierii Zarządzania, Poznan (2008)
21. Mnich, J.: *Strategia i struktura organizacyjna a podejście procesowe w zarządzaniu uczelnia publiczna*. Dissertation, Lodz (2018)
22. Wisniewska, M., Wisniewski, Z.: The relationship between knowledge security and the propagation of innovation. *Adv. Intell. Sys. Comput.* **783**, 176–184 (2019)
23. du Valla, M.: *Raport koncowy „Modele zarządzania uczelniami w Polsce”*. Uniwersytet Jagielloński Centrum Badan nad Szkolnictwem Wyższym, Krakow (2011)
24. Nazarko, J., Ejdyś, J., Halicka, K., Magruk, A., Nazarko, L., Skorek, A.: Application of enhanced SWOT analysis in the future-oriented public management of technology. *Procedia Eng.* **182**, 482–490 (2017)
25. Kaleta, A.: Zarządzanie strategiczne jako proces. Studium przypadków. *Prace Naukowe Uniwersytetu Ekonomicznego we Wrocławiu* **52**, 49–57 (2009)
26. Schermerhorn, J.R., Ehrlich, A.: *Zarządzanie: kluczowe koncepcje*. Polskie Wydawnictwo Ekonomiczne, Warszawa (2008)
27. Dąbrowski, J.: *Zmiany strategiczne w teorii i praktyce zarządzania*. Wyższa Szkoła Przedsiębiorczości i Zarządzania im. Leona Kozmńskiego, Warszawa
28. Wisniewski, Z., Mnich, J.: A change of approach to management from the functional to the process one—a human factor and an administrative factor in a public university. *Adv. Intell. Syst. Comput.* **605**, 164–170 (2018)
29. Steinmann, H., Schreyogg, G., Martan, L., Galdzicki, Z.: *Zarządzanie: podstawy kierowania przedsiębiorstwem. Koncepcje, funkcje, przykłady*. Oficyna Wydawnicza Politechniki Wrocławskiej, Wrocław (2001)
30. Greenleaf, R.: *Servant leadership*. Paulist Press International (1992)



ERP Research on the Influence of Different Types of Leadership Behavior on the Performance of Quality Management

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Abstract. This study had used the method of cognitive neuroscience to research the influence of different types of leadership behavior on the performance of quality management and verified the scientific of leadership behavior theory from the perspective of empirical science. Experimental results showed that different leadership styles significantly affected the accuracy, reaction time, attitude and contextual performance of the individuals in completing the task. There was obviously different influence on 1000–2100 ms brain waves in the process of task completion. The gender played an important regulatory role.

Keywords: Leadership style · Event-related potential technique · Leadership effectiveness · Attention · Emotion

1 Introduction

“Leadership” is the core of quality management, which is relative to the effective functioning of the organization. It is a key factor to ensure the “masses participate actively” [1]. At present, the leadership theory research is mainly characterized by two broad categories, the leadership characteristics theory and leadership behavior theory. Leadership characteristics theory is that the quality of leadership is born features. Person without this natural trait cannot be a leader by learning [2]. Leadership behavior theory is that different leadership behavior has great influence on leadership effectiveness and organization performance. Effective leadership behavior can be obtained from the training and shaping in the future. Quality management performance generated by “leadership” is called the leadership effectiveness, which is mainly measured through performance or satisfaction of the team or employee. Among them, the performance includes task performance and contextual performance. Task performance, often refers to the one set in job roles in advance, measured by quality, yield, efficiency, etc. It is mainly affected by the abilities and skills of the individual. Contextual performance refers to all actions which can promote the happen of task performance by

providing a good environment to help organizations promote efficiency. It is not prescribed beforehand in the work role, mainly affected by the individual’s personality characteristics. Therefore, in terms of ascending leadership effectiveness, leadership characteristics theory emphasizes too much on congenital of leadership traits, which is limited in increasing leadership effectiveness. The leadership behavior theory gradually becomes the core of leadership theory research because its practical guiding role in the effectiveness of the leadership, which is the main theoretical basis to improve the effectiveness of the leadership.

Leadership behavior theory summarized the leadership behavior as “structure” and “care” two dimensions at first [3], which represented the care to production and human. According to these two dimensions, leadership behavior was divided into “task orientation” and “employee orientation” two kinds of style by traditional research. The employee orientation leaders pay attention to interpersonal relationships, respect the opinion of the subordinates and acknowledge differences between people. Task-oriented leaders more emphasize on the realization of the goal, clear the responsibilities, help members to complete the intended target and take the members of the organization as a means to achieve objectives [4]. Later, the researchers found that in addition to the traditional employee orientation and task orientation, some leaders had both employee orientation and task orientation two styles. There were even leaders who did not show any style. Based on this, establish the two-dimensional quadrant of leadership behavior with “structure”, “care” two dimensions coordinate system and expand the traditional leadership theory to quaternion, as shown in Fig. 1 [5].

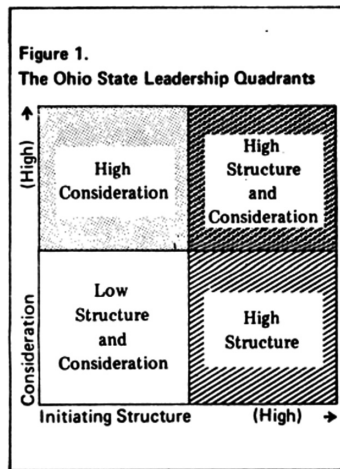


Fig. 1. Leadership behavior theory of quaternion

Many studies have shown that relationship-oriented leadership type will lead to higher employee satisfaction. In 1976, Stan E conducted an empirical study on the influence of interaction effects of leadership behavior, subordinate character and task

types on task performance. The research divided leadership behavior into three categories: high task and low relationship orientation, low task and high relationship orientation and high task and high relationship orientation. The results showed that the interaction effects of leadership behavior, subordinate character and task types had great impact on the task performance. Staff satisfaction of high task and high relationship is the highest, followed with low task and high relationship. The satisfaction between leaders and employees with high task and low relationship was the lowest [6]. On the impact of different leadership to the team, the University of Michigan also had related research. During the 20 years from 1950 to 1970, series of the experimental results of the university showed compared with the task model, the relational model leadership behavior would lead to higher employee satisfaction and productivity [7]. Chen and Zhou used questionnaire survey method to research the relationship between leadership behavior, organizational learning ability and organizational performance [8]. It found that entrepreneurial leadership behavior has a significant influence on organizational learning ability. The effect of relationship orientation behavior was better than working orientation behavior. Katz et al. studied 24 business leaders and 419 employees they led distributed in the high productivity and low productivity teams [9]. Results showed that high productivity team leaders were more inclined to relationship orientation rather than task orientation. Hodge carried out a study on types of leadership behavior of the first managers and the secondary managers of an enterprise. It found the satisfaction of the first managers to task-oriented leadership was higher [10]. Kuehl took the 35 teams each with 6–8 people of a farm machinery production unit as experiment object. It found that for the work team similar to committee, the task performance of the task-oriented leadership was higher [11].

In the 20th century 60s and 70s, the leadership behavior theory gradually evolved into a contingency theory (also known as situational theory), which attached great importance to the situation to influence the effectiveness of the leadership behavior and believed that situational factors could be separated. But practitioners were difficult to determine the contingency variables such as leadership members and task structures, which had some limitations in application. At present, empirical research on the effect of leadership behavior on team performance and employee, satisfaction is adopted with the method of questionnaire survey, the results of which are not the same. In view of the limitations of the measuring methods of questionnaire, how different leadership styles influence the management performance by individual behavior is not clear. With the development of cognitive neuroscience, cognitive neuroscience technology has been widely applied in areas such as management, ergonomics and economics. This study used experimental measurement technology integrated the scenario simulation, EEG recording and behavior data analysis and auxiliary questionnaire survey method to test the influence of different leadership task assignment styles on task performance and contextual performance. We studied how different leadership styles affected on the management performance by individual behavior to explore the influence of different leadership behavior on individual task performance.

2 Method

2.1 Experimental Design

Leadership behavior is usually characterized by task assignment, authorization and motivation, etc. Task assignment is a major aspect of leadership behavior. This research adopted the CNV experimental research paradigm and the simulated experimental situation of “leadership assigned tasks” to study how different leadership task assignment ways influence task and contextual performance through individual. The independent variable was the leadership task assignment way, including three levels, namely, employee orientation, task orientation and both comprehensive orientations. Intermediate variables were the motivation, ability, attitude and emotion of the individual. The dependent variables were task and contextual performance, including task completion accuracy, task response speed, degree of concentration, mood, emotion and brain wave response, etc. Among them, the independent variable was shown through the recorded video materials, in which a male leader and a female leader assigned the tasks in three different leadership styles. Video material was evaluated, which was accord with the experimental research purposes and requirements. The dependent variable was the brain wave amplitude and the behavior data of completing the task.

2.2 Subjects

32 on-the-job staff and students between 17 and 32 years old participated the experiment as typical representative. The on-the-job staff and students (mainly for undergraduate or graduate) were half and half. All the participants were physical and mental health with no history of neurological or psychiatric disease. The average age was 23.60 years.

2.3 Experimental Process

Before the trial subjects signed the informed consent form and general information such as registration of demographic characteristics. This experiment simulated the leadership tasks assignment situation. The subjects watched video and accepted tasks. At the same time using the event related potential research technology to record their brain scalp EEG and behavior reaction data. Investigate the reaction time and accuracy of the mission completion and emotions and emotional reactions of the brain. At the end of the experiment use the five-point scale evaluation questionnaire to survey concentration condition in the process of task completion. After the experiment was all over, give participants certain reward.

2.4 Experimental Data Analysis Methods and Tools

Use Neuroscan software and SPSS19.0 to analyze the EEG experimental data, behavior data and questionnaire data. Analyze the impact of different ways of leadership tasks assignment on task performance and contextual performance.

3 Results

3.1 The Influence of Different Leadership Styles on Task Completion Rate of Individual

Accuracy reflects the accuracy degree of the individual to complete the task. It can reflect the individual's motivation level to a certain extent. The results in Table 3 show that the task completion accuracy of comprehensive orientation is the highest, followed by employee orientation. The task completion accuracy of task orientation is the lowest. But the accuracy results of the male and female subjects to different gender leadership task assignment are inconsistent. The accuracy of the male subjects to comprehensive orientation of male leaders' task assignment way is the highest. While to the female leaders, the accuracy of the task orientation assignment style is the highest. The accuracy of the employee orientation assignment style of the female subjects is the highest. To male leaders, the accuracy of the task orientation way is the lowest. To female leaders, the accuracy of the comprehensive orientation way is the lowest. From the perspective of the gender impact of leaders, whether they are male or female subjects under leadership of men, the accuracy of comprehensive orientation is the highest. The results under the leadership of the women are not consistent. Analysis found that the interaction of the different styles of leadership and different genders were critical significant ($F = 3.110$, $P = 0.052$). Simple effect analysis shows that task completion accuracy of the female subjects under the condition of male leaders assign task is higher than that under the condition of female leaders assign tasks. The critical difference is significant ($F = 3.42$, $P = 0.075$). There are significant differences in task completion accuracy of different leadership styles of the male leaders ($F = 3.110$, $P = 0.024 < 0.05$). It shows that the task completion accuracy of the comprehensive orientation is the highest, followed with employee orientation. The task orientation is the lowest. But the influence of different gender leaders on the task completion accuracy is critical significant different ($F = 3.952$, $P = 0.057$). Comparison shows that the task completion accuracy under the condition of male leaders is higher than that under the condition of women's leadership ($t = 0.021$, $P = 0.057$) (Table 1).

Table 1. The average individual task accuracy under different experimental conditions (%)

		Employee orientation	Task orientation	Comprehensive orientation
Male subjects	Male leaders	93.67%	96.33%	97.33%
	Female leaders	93.33%	95.00%	94.67%
Female subjects	Male leaders	98.00%	94.67%	97.33%
	Female leaders	95.67%	93.33%	92.67%
Total		95.17%	94.83%	95.50%

3.2 The Influence of Different Leadership Styles on Task Completion Response Time of Individual

Response time data reflects speed of the subjects to complete the task. To a certain extent, it reflects the individual’s ability to complete tasks. Table 4 shows that the response time of the task orientation is the longest. The response time of employee orientation and comprehensive orientation is close and both of them are faster than the response time of task orientation. The response time of the male subjects is faster than that of the female subjects. In general, there is no significant difference in response time data. There is no difference in the response time of the male subjects to the male leaders’ three task assignment styles. They are basically the same. While to the female leaders, the response time of task orientation is slower than that of the employee orientation and comprehensive orientation. That means the male subjects are easier to be influenced by the different assignment ways of opposite sex leaders. To the female subjects, whether under the leadership of male or female, the response time of task orientation is longer than that of employee orientation and comprehensive orientation. But the patterns of different gender leaders under employee orientation and comprehensive orientation conditions are different. To male leaders, the response time of employee orientation is faster than comprehensive orientation. To female leaders, the response time of comprehensive orientation is faster than that of employee orientation. Comprehensive comparison shows that the different feelings of male subjects to the female leader’s task assignment styles are more apparent. The feelings of female subjects to the male leader’s task assignment styles are more in line with the intention of the task allocators. Therefore, in general, when the leaders and executors are matched in different genders, the feeling to different leadership styles of task allocators is more sensitive (Table 2).

Table 2. The response time under different experimental conditions

		Employee orientation	Task orientation	Comprehensive orientation
Male subjects	Male leaders	226	226	225
	Female leaders	225	230	223
Female subjects	Male leaders	255	281	269
	Female leaders	255	263	241
Total			250	239

3.3 The Influence of Different Leadership Styles on Individual’s Attitude and Contextual Performance

Concentration degree in a certain extent reflects the effects of leadership on individual’s attitude. It is the embodiment of the leading behavior affects the quality management contextual performance. The subjective report in Table 5 shows that the concentration degree of employee orientation, task orientation and comprehensive orientation are in consistent pattern. The task orientation is the most concentrated, followed with comprehensive orientation. The concentration degree of the employee orientation is the

lowest. It shows that under the condition of task orientation, the attitudes of the subjects are the most serious. Variance analysis results show that under the condition of task the main effect is significant ($F = 4.871$, $P = 0.012 < 0.05$). Further analysis shows that the concentration degree of the task orientation is significantly larger than that of the employee orientation ($t = 0.423$, $P = 0.019 < 0.05$). The difference of concentration degree between task orientation and comprehensive orientation is critical significant ($t = 0.298$, $P = 0.077$). The concentration degree of the employee orientation and comprehensive orientation is not notably different. Simple effect analysis shows that under the task orientation condition the concentration degree of male leaders is notably higher than that of the female leaders ($P = 0.019 < 0.05$).

From the point of gender effects, the different leadership styles of the same gender leaders are in consistent pattern with striking difference. But to different gender leaders it shows disparate patterns. Specifically, there is no obvious difference in concentration degree of male subjects to various leadership ways of the female leaders. But the female subjects' concentration degree to task orientation of male leaders is higher than that to employee and comprehensive orientation. No discrepancy exists in the attitude to the employee orientation and comprehensive orientation. They show the same concentration level. The attitudes of male subjects to male leaders' disparate leading ways and female subjects to female leaders' disparate leading ways are in the same pattern. The concentration level of the employee orientation is lower than that of the comprehensive orientation, the level of which is lower than that of the task orientation (Table 3).

Table 3. Self-evaluation results of the concentration degree under different experimental conditions

		Employee orientation	Task orientation	Comprehensive orientation
Male subjects	Male leaders	3.65	4.19	3.88
	Female leaders	3.88	3.92	3.96
Female subjects	Male leaders	4.23	4.81	4.23
	Female leaders	3.81	4.35	4.00
Total			4.32	4.02

3.4 The Influence of Different Leadership Styles on Individual's Emotions

CNV amplitude changes in brain waves reacts the effect of different leadership styles to individual's emotion and attention state. Choose a scale of 0–500 ms, 500–1000 ms, 1000–2100 ms and 2100–3000 ms four periods to analyze. The results demonstrate that the main effect discrepancy of the three leadership styles in disparate periods is obvious ($F = 9.546$, $P < 0.01$). The interaction of disparate periods and leaders' genders is critical significant ($F = 3.227$, $P = 0.078$), others are not remarkable. Simple effect analysis shows that the discrepancy of three task assignment ways in disparate

periods is striking ($P_s < 0.01$), which means the influence level of various leadership ways to disparate periods of preparing time is not the same. But in disparate periods, the discrepancy of the three assignment ways is not in a remarkable level. Further analysis reveals that in the period of 1000–2100 ms the amplitude of brain waves is obviously negative than that in other three periods ($P_s < 0.05$). The amplitude of comprehensive orientation is negative than that of task and employee orientation. The amplitude of task orientation is negative than that of employee orientation (Table 4).

Table 4. Brain wave amplitude variation in different periods caused by different leadership styles

	Employee orientation	Task orientation	Comprehensive orientation
0–500 ms	0.430	0.207	-0.230
500–1000 ms	-0.448	1.023	-0.555
1000–2100 ms	-3.437	-4.037	-4.985
2100–3000 ms	1.419	0.701	0.658

The interaction of disparate periods and leaders’ genders is taken the simple effect analysis. It found the brain wave amplitude in disparate periods was notably different under the conditions of male leaders and female leaders. It revealed whether it was male leaders or female leaders, the emotion state changes in disparate periods all represented various response conditions. In the way of employee orientation, the disparity of the brain wave amplitude of leaders with different genders was critical significant ($P = 0.069$). In the period of 500–1000 ms, the brain wave amplitude of the male leaders was remarkably negative than that of the female leaders. In other periods, no striking disparity existed in leaders with different genders. Various subjects only showed critical difference in 2100–3000 ms periods. The brain wave amplitude of the female subjects was notably positive than that of the male subjects ($P = 0.069$) (Tables 5 and 6).

Table 5. Brain waves amplitude comparison of employee orientation with different genders in disparate periods

		0–500 ms	500–1000 ms	1000–2100 ms	2100–3000 ms
Male subjects	Male leaders	1.135	-0.135	-3.986	-2.502
	Female leaders	0.449	-1.284	-4.944	0.554
Female subjects	Male leaders	-0.001	-1.433	-4.602	2.295
	Female leaders	0.256	0.971	-0.557	4.529

Table 6. Brain waves amplitude comparison of task orientation with different genders in disparate periods

		0–500 ms	500–1000 ms	1000–2100 ms	2100–3000 ms
Male subjects	Male leaders	-0.191	-0.941	-6.251	-1.875
	Female leaders	0.669	-0.492	-2.863	2.849
Female subjects	Male leaders	0.500	2.594	-3.161	-0.576
	Female leaders	-0.137	2.350	-4.046	2.336

In the comprehensive orientation assignment way, the interaction of periods, different gender leaders and different gender subjects is obvious ($F = 6.429$, $P < 0.01$). In the periods of 1000–2100 ms and 2100–3000 ms, the discrepancy under different gender conditions was remarkable ($P_s < 0.05$). Female leaders were notably positive than that of the male leaders in the period of 1000–2100 ms with the same result in the 2100–3000 ms period ($P < 0.05$). Under disparate periods and different genders conditions, the disparity in only the 500–1000 ms period was critical significant ($p = 0.086$). On the male leader factor, the disparity of brain waves amplitude of different gender subjects was critical significant ($F = 6.429$, $P = 0.099$). The brain wave amplitude of the male subjects was more negative (Table 7).

Table 7. Brain waves amplitude comparison of comprehensive orientation with different genders in disparate periods

		0–500 ms	500–1000 ms	1000–2100 ms	2100–3000 ms
Male subjects	Male leaders	–0.009	–1.759	–6.531	–3.472
	Female leaders	–1.475	–2.820	–5.610	1.216
Female subjects	Male leaders	0.092	2.056	–2.095	3.912
	Female leaders	0.300	–0.274	–6.066	0.383

4 Discussion

4.1 Important Influence of Different Leadership Behavior on Quality Management Performance

The data of behavior and EGG showed that the influence of different leadership styles on quality management performance was great. It not only affected the individual's intermediary variables such as motivation, ability, attitude and emotion in the process of completing the task but also affected the task performance and the contextual performance of quality management. In terms of the accuracy of the behavior outcomes, the accuracy of comprehensive orientation was the highest, followed with employee orientation. The accuracy of task orientation was the lowest. This aspect showed that comprehensive orientation leadership style can contribute to the accuracy of completing the task. But the task orientation leadership style may bring pressure to the subjects, which can affect the accuracy. In terms of response time, task orientation was the longest. The response time of employee and comprehensive orientation were fairly close, which were faster than that of the task orientation. In the aspect of concentration, task orientation was the most concentrated, followed with comprehensive orientation. The concentration degree of the employee orientation was the lowest. The results of the several aspects synthetically demonstrated that under the task orientation condition the attitude of the subjects was the most serious, the concentration of which was notably higher than that of the employee orientation.

The results of the brain waves showed that the brain waves response of the three leadership styles in 1000–2100 ms period, which was more negative, was notably different from those in other three periods. The discrepancy of the three task assignment

ways was remarkable in disparate periods, which showed that the influence of various leadership styles on disparate periods of the preparing time was different. Especially in the 1000–2100 ms period, the brain waves of the three assignment ways were notably more negative than those in other three periods.

The preparing condition under comprehensive orientation condition was better than that in task and employee orientation conditions. The preparing condition under task orientation was better than that of employee orientation.

The overall results showed that the influence of three task assignment on quality management performance was important. The best period which affected the individual's emotion was 1000–2100 ms before start when the brain was at the best preparation status.

4.2 Gender Plays an Important Regulatory Role in the Interaction of Leaders and Task Executors

Further analysis of the research results found that the interaction pattern of the leaders and task executors was different. Leadership styles played a various role in the leaders and followers with different genders. Gender was of vital importance. There was different influence effect of the leadership styles on the quality management performance as the disparity of the gender match between the leaders and followers. From the view of the behavior data, in terms of the task completion accuracy, the task performance of the employee orientation of the female subjects was the highest with the highest task completion accuracy. While, the task performance of the male subjects was the lowest under the employee orientation condition. For the female subjects, the accuracy of the female leaders in the comprehensive orientation style was the lowest. For the male subjects, the accuracy to the male leaders under comprehensive orientation assignment was the highest. To female leaders the accuracy under task orientation way was the highest. In terms of response time, it was faster for the male subjects than that of the female subjects. From the subjective report of the concentration degree of the subjects, it represented disparate patterns. Consistent discrepancy existed in the various leadership styles to the same gender leaders, and there was remarkable difference between them. While it showed disparate patterns for the leadership styles of the different gender's leaders. Specifically speaking, the attitude for the male subjects to the different leadership styles of the male leaders showed the same pattern as that for the female subjects to the different leadership styles of the female leaders. The concentration degree of the employee orientation was lower than that of the comprehensive orientation, the concentration of which was lower than that of the task orientation.

EGG data showed that under both male and female leaders the brain waves amplitude of disparate periods was obviously different. In employee orientation assignment style of 500–1000 ms period, the brain waves of male leaders were notably negative than that of female leaders, which showed more suppressive emotional state to prepare the task. In 2100–3000 ms, the brain waves of female subjects were remarkably positive than those of the male subjects. The emotional state of the male subjects was more beneficial to finish the task in inhibitory state. In comprehensive orientation assignment way, the interaction effect among periods, leaders and subjects with different genders was significant. In 1000–2100 ms and 2100–3000 ms periods, male

leaders were notably negative than the female leaders. But in 500–1000 ms period, the brain waves amplitude of the male subjects was negative than that of the female subjects, which showed a better task preparation status. The response time of the male subjects in the three leadership styles was faster than that of the female subjects because of its influence. And it also resulted in the high accuracy under comprehensive and task orientations. This also demonstrated that the emotion and attention state can influence the task performance, which expressed different results in disparate genders.

Therefore, different leadership styles can affect quality management performance. But the gender match between the leaders and followers was an important intervening variable, which played a crucial role in the quality management performance. Hence, the leadership styles in quality management should not only consider the task assignment ways, but also the gender match problem between leaders and followers.

4.3 Further Study on the Mechanism of How Leadership Behavior Influences the Performance of Quality Management

This study showed that the leadership behavior can influence the quality management performance. But the leadership itself was a complex factor, which included the characteristics and behavioral pattern of the leaders, even some congenital genetic factors like image of leaders, affinity, appearance characteristics, etc. In addition to the leadership behavior, other personal information of the leaders also influenced the followers' understanding and cooperation degree to the information, like the mood, tone and cadence of the voice, etc., which may influence the motivation, attitude and emotion of the task executors and further affected the quality management performance. There will also be involved the reaction of the followers to tone and behavior style of the leaders. There was interaction between the reactive modes of the leaders and followers. Therefore, the influence of leadership styles on quality management performance was a complex research topic. This study only carried out an exploratory experimental research on how leadership behavior influenced the quality management performance from the three task assignment ways of the leaders. It also contained the effect of gender match between the leaders and followers. But these only referred to one aspect of how leadership behavior influenced the quality management performance. The influence of leadership behavior on quality management performance needs to devise a series of experiments from disparate aspects to further analyze the mechanism on how leadership behavior and the related factors affect the quality management performance.

5 Conclusion

The leadership behavior research of the organizational behavior mainly stays in the stage of theoretical exploration. The experimental verification of related theory research is less. This study used brain cognitive neuroscience test method to study the inner feelings and emotional reaction of the subjects to different styles of leadership, which takes a positive stab at researching the leadership behavior theory. This study enriched the research achievement on quality management performance before. We can design

experiments with different conditions in future to provide more experimental technique support for further analyzing the quality management performance study. In addition, as the diversity and complexity of the social management problem, the task in this study was relatively simple, which did not come down to complicated task and simulate the diversity conditions in real society. It may impact the interpretation validity of the data results. It was hard to reproduce the complexity of real society in experimental conditions. It was also difficult to seriously control the complicated and changeable influencing factors in management and sociology field during the experiment. It is research direction in future.

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References

1. ISO10018: Quality management system—guide—people participation and competent (2012)
2. Organ, D.W.: Leadership: the great man theory revisited. *Bus. Horiz.* **39**(3), 1–4 (1996)
3. Hemphill, J.K.: The leader and his group. *Educ. Res. Bull.* 225–246 (1949)
4. Zhao, G.: The present situation and prospect of the leadership theory research. *J. HeNan Univ. (Soc. Sci. Ed.)* **49**(3), 134 (2009)
5. Hersey, P., Blanchard, K.H.: Life cycle theory of leadership. *Training Dev. J.* (1969)
6. Weed, S.E., Mitchell, T.R., Moffitt, W.: Leadership style, subordinate personality, and task type as predictors of performance and satisfaction with supervision. *J. Appl. Psychol.* **61**(1), 58–66 (1976)
7. Bass, B.M., Stogdill, R.M.: Handbook of leadership. *Theory, Res. Manag. Appl.* **3** (1990)
8. Chen, G., Zhou, W.: The study on the relationship between the leadership behavior, organizational learning ability and the organization performance. *Sci. Res. Manag.* **5**, 148–154 (2009)
9. Katz, D., Maccoby, N., Morse, N.: Productivity, Supervision, and Morale in an Office Situation. University of Michigan, Institute for Social Research, Ann Arbor (1950)
10. Brown, B.B.: Employees’ Organizational Commitment and Their Perception of Supervisors’ Relations-Oriented and Task-Oriented Leadership Behaviors. Virginia Polytechnic Institute and State University (2003)
11. Kuehl, C.R.: Leader effectiveness in committee-like groups. *J. Bus.* **50**, 223–230 (1977)

Leadership, Change Process and Technology



Applying Safety Leadership and Systems Thinking to the Formal and Informal Controls Approach Used in Safety and Risk Management Within the French Nuclear Sector

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Abstract. This paper proposes a new approach to risk and safety management, underpinned by systems thinking, applying safety leadership principles to develop and overcome the limits of Management Control Systems (MCS) used in two nuclear facilities of the French Atomic Energy and Alternative Energies Commission (CEA). These facilities execute similar activities by subcontracting, but have different managerial configurations. Using systemic thinking, 18 MCS common to both facilities were identified and an evolution of how one facility implements several of these MCS was observed; pinpointing dimensions of the Empowerment Leadership Model (EML) as a gearshift to this change. This research illustrates how CEA managers implement safety leadership to reinforce risk prevention in their management of safety and of human and organizational factors. The implications of these findings are discussed by detailing how they may transform current and future MCS contractor-subcontractor practices, thereby responding to the continually evolving demands of the nuclear industry.

Keywords: Management Control Systems (MCS) · Systems thinking · Risk management · Safety management · Subcontracting · Human and organizational factors (HOF) · Nuclear Power Plants (NPP)

1 Introduction

France's nuclear power plants (NPP) generate 70% of the total electricity by means of the 58 nuclear reactors in operation (13% of the worldwide reactors in operation) [1]. Given the consequences of safety anomalies at any of these French NPPs and its impact on human safety, safety management of NPPs is an international issue. Research demonstrates that safety issues in nuclear plants are rooted in human and organizational

factors [2–4], all the more important given that safety barriers are designed and built by humans. These concerns apply also to nuclear research facilities operated by CEA.

The International Atomic Agency Report (IAEA) [5] highlights the importance of human factors in nuclear safety and illustrates the lessons learnt from three NPP accidents. The Three Mile Island accident in 1979 acknowledged the existence of non-technical aspects in nuclear operations [5]. The Chernobyl accident in 1986 highlighted the importance of safety culture, management and organizational factors in nuclear safety [5]. The Fukushima Daiichi accident in 2011 accentuated the need to complement traditional safety approaches with a systemic approach, thereby considering the interactions between human, organizational and technological factors that contribute to safety, as well as the complexity of the interrelationship among them [5, 6].

In recent years, numerous scholars have emphasized the need for system-oriented approaches to technical and organizational safety [7–9]. Recent studies demonstrate that safety performance is influenced by leadership [10–16]. Additionally, the IAEA reports [5, 6] call for effective leaders as leadership is viewed as a “shift lever” for safety culture and as an important precursor to obtaining high levels of safety [5, 6, 12–14] and hence an antecedent to effective safety management. Such statements affirm the importance of applying safety leadership principles underpinned by systems thinking to organizational controls used by the French Atomic Energy and Alternative Energies Commission (CEA) in their safety and risk management practices. These nuclear facilities subcontract a percentage of their work that yields strategic and economic advantages [17], but may expose both parties to a great deal of risk [9, 18] as for example each organization may have different agendas [19]. This risk is exacerbated by the organizational distance between two separate entities of the contractor-subcontractor relationship. However, MCS such as *formal controls* (*rules, policies and procedures for monitoring and rewarding performance*) and *informal controls* (*shared values, beliefs*) contain limits since most are based on the observation and evaluation of the elements declared by the subcontractor as the contractor is not physically present to observe and evaluate all the safety items.

As such, attention is drawn to the empowerment leadership model (ELM) [20] one of the most recent models to emerge in the safety leadership literature surrounding NPPs [12–14] that accounts for task and person focused behaviors. Empowering leadership occurs when the leader shares authority and allocates responsibilities and autonomy to his team members by augmenting the meaningfulness of their work, by conveying confidence in high performance, and by encouraging participation in decision-making [21].

This study identifies several dimensions of the ELM at the source of several changes in the formal and informal controls implemented in safety management practices at one of the nuclear facilities of the CEA. By combining a systems thinking approach to safety leadership with a systems thinking approach to MCS, managers can complement task oriented MCS practices with the more human approach of leadership. The following sections introduce the research constructs (systems approach, MCS, safety leadership) and the leadership model utilized in this study.

1.1 The Systems Approach

Systems approach and systems theory has been progressively recognized within the safety science literature as an essential factor in examining safety within complex socio-technical systems [4, 5, 7, 8, 22] and as an important complement to traditional safety approaches. The systemic approach to safety addresses a complex system of interactions across every level of the organization, by initially identifying interactions between human, organizational and technological factors and then considering the complexity of the interrelationship amongst them [5, 6, 23]. Consequently, the CEA employs a systems thinking approach in their HOF approach to safety that is concerned with “human failure and the unsafe acts carried out by workers, as well as the factors within the system that influence human performance directly or indirectly; viewed from a human and social science perspective” [8] across different levels of the organization.

Safety is viewed as a “control problem” and safety is managed by a control structure embedded in an adaptive socio-technical system [23]. Accidents or incidents are the result of degradation in the safety system’s performance due to the interaction of several causal factors at multiple-levels (component failures, external disturbances, and/or dysfunctional interactions among system components) rather than a single causal factor at a single level [23]. Therefore, preventing accidents requires designing a safety control structure that is large enough to encompass all of the managerial factors that influence the system’s development and its operations [23]. As such, system thinking in combination with organizational tools can provide opportunities for productive dialogues and methods for leaders to create and implement fundamental changes and improvements within the organization leading to sustained superior safety performance.

Safety may be considered as a social activity and management cannot bring about effective safety performance alone [24]. Instead, in a “plural leadership perspective” [25], leadership roles (skills and responsibilities) can be dispersed throughout different levels of the organization over time, permitting multiple actors to adopt leadership roles encourages more widespread implementation and adoption of safety practices; thereby enhancing safety compliance.

1.2 Management Control Systems (MCS)

Management control is the process by which managers influence other members of the organization to implement the organization’s strategies. MCS have been described as a collection of control devices that serve as “*a system of organizational information seeking and gathering, accountability and feedback designed to ensure that the enterprise adapts to changes in its substantive environment and that the work behavior of its employees is measured by reference to a set of operational sub-goals (which conform to overall objectives) so that the discrepancy between the two can be reconciled and corrected for*” [26] (p. 8). Given this definition, MCS are useful in the management of both intra-organizational and inter-organizational actors [27] such as the contractor-subcontractor relationship that due to the distance between firms requires a resourceful management of systems and controls.

The development and implementation of **formal** control mechanisms and **informal** control mechanisms in an organization enables managers to strategically obtain results [28, 29]. An organization has two types of formal controls [22, 30]: behavior and output controls. **Behavior controls** or process controls standardize the work process using prescriptive rules, policies and procedures often measuring the behavior to ensure the process is appropriate and performed according to the pre-determined specifications [18, 29–31]. Behavior controls ensure the subcontractor adheres to safety regulations by applying rules and behavior prescribed by the contractor or the external regulatory authorities. **Output controls** measure the results of this behavior through a feedback control process that contrasts output measures with performance and organizational objectives [18, 29–31].

Output control serves as an accurate assessment of key performance measures, allowing contractors to adjust changes to those measurements thereby ensuring subcontractors implement their skills and resources to obtain results that comply with safety regulations. Finally, **informal** or **social controls** minimize goal discrepancies between the contractor and the subcontractor by establishing common culture, values and beliefs [18, 30, 31], thereby ensuring the convergence of objectives or the compatibility of non-convergent safety objectives.

Given the complexity and the plethora of managerial controls, it is essential to explore the design of MCS using a systems thinking approach, in order to identify the most suitable design components and their interactions at multiple levels of the organization. However, research indicates that the simple reinforcing of rules and procedures is insufficient to foster safe workplace behaviors; therefore, it is essential to complement MCS with other elements to ensure positive safety behavior outcomes.

1.3 Safety Leadership

Leadership is recognized as a key element in safety culture and an integral part of safety management within NPP [5, 6, 12–14]. **Safety leadership** is a “*process of interaction between leaders [managers] and followers [subcontractors], through which leaders could exert their influence on followers to achieve organizational safety goals under the circumstances of organizational and individual factors*” [10]. A central feature of leadership (in contrast to management) is the embodiment of processes through non-coercive influence [12, 32]. Instead, the leader uses his capabilities and competences to persuade individuals and groups to perform activities that they would not have initially carried out had their leadership not been enforced [12, 16, 33].

Empirical studies from a variety of industrial sectors (manufacturing, construction, chemical industries, metal processing and the food industry) have studied well-known leadership approaches such as transformational leadership [16, 32–34] and leader-member exchange (LMX) [35]. Through LMX, employees have a greater propensity to commit themselves to safety and maintain an open communication about safety when they consider the organization supports them and when they sense a high quality relationship with their leaders [35, 36].

Burns [37] proposes two leadership styles: **transactional leadership** that resembles formal MCS as it focuses on compliance of contractual obligations by establishing objectives, monitoring and controlling results [16, 33, 34]; and **transformational**

leadership which parallels informal MCS as it motivates followers to improve performance by transforming followers' attitudes, beliefs and values as opposed to simply training compliance) [16, 33, 34]. Burns [37] believed that transformational leadership and transactional leadership are at opposite ends of a continuum. However, Bass [34, 38] suggested that transformational leadership augments the effects of transactional leadership by encouraging followers to exceed expected performance, yielding follower satisfaction and commitment to the group and organization [34].

Leadership studies on safety performance in the nuclear industry are limited, but have been studied at different managerial levels. At the medium management level, communication and feedback were associated with safety performance [39]. At the senior level, leaders with stimulating, individually considerate and rewarding leadership styles impacted workers' behaviors and obtained better safety results [11]. Another study advocates that the most effective leadership style at all leadership levels in NPP is one characterized by flexibility, the development and implementation of new ideas and the encouragement of new initiatives [40]. All of these studies emphasize the importance of supervision levels in NPPs and the leadership style of those supervisors, as effective safety leadership results from maintaining a balance between caring and controlling [38].

Literature on MCS and leadership complement each other and may improve the understanding and implementation of safety practices in NPP among all levels of the organization [32]. While MCS provide effective, measurable and transparent manners of shaping and controlling human behavior, they may be criticized as lacking concern for human characteristics such as the need for motivation, flexibility and personal development [32]. On the other hand, while safety leadership drives loyalty, safety culture and social dynamics through non-coercive actions, such leadership criteria are difficult to quantify and measure, making it difficult to determine leadership performance [32]. Due to the complementing nature of MCS and safety leadership, successful integration of one into the other's implementation can make a significant impact in the organization's safety management practices.

The present study aims to expand the findings of Safety leadership and Management Contract Systems in the Nuclear Industry in three ways. First, by highlighting the similarities between transactional and transformational leadership styles used in safety management and formal and informal MCS used in the prevention and mitigating nuclear related subcontracting risks. Second, by employing the empowerment leadership model (detailed in the following section) that includes elements of both transactional and transformational leadership, to better comprehend the evolution of certain MCS observed at one of the nuclear facilities. Finally, by illustrating how CEA managers employ an empowerment leadership approach that accounts for human factors (*person-focused*) to reinforce organizational MCS practices (*task-focused*).

1.4 Empowering Leadership (EL)

The ideal type of leadership style instrumental in the highly regulated work context within NPP remains inconclusive, particularly as most leadership theories focus on enhancing effectiveness and efficiency of employee performance neglecting the safety aspect, a core element of NPPs. The empowerment leadership (EL) style has been

suggested to embrace leadership behaviors especially relevant for NPPs [12–14], as empowered leaders in the nuclear sector produce compliance with safety procedures and requirements, enhance safety participation behaviors and reduce risky behavior [14]; making it a potential precursor for safety performance. In fact, EL positively enhanced perceived safety behavior of subordinates by means of safety environment in NPPs with both a strong and a weak safety culture [12].

The Empowerment Leadership Model (ELM) proposed by Arnold [20] claims the main function of a leader is to increase (through his or her behavior) the team's potential for self-management. The ELM distinguishes five dimensions that empowering leaders ought to exhibit and can be applied to strengthen the organization's safety systems and procedures. By **leading by example**, the leader demonstrates their commitment to safety and creates cohesion between what is said and done [13]. **Coaching** encourages subordinates to solve problems thus providing members an opportunity to share and increase their knowledge. Member's well-informed ideas and opinions can be integrated through **participative decision making**, therefore, encouraging other members to express their opinions. Disseminating information, that is **informing** members on a regular basis of safety initiatives and changes in procedures; as well as **showing concern/interacting with employees** opens a dialogue and a positive rapport between leaders and team members [13]. Part of ELM's strength and relevance in NPPs is that it amalgamates both **task-focused behaviors** (*informing*) and **person-focused behaviors** (*showing concern*) thereby, on one hand, facilitating the understanding of task requirements, operating procedures and their compliance [12–14], while on the other hand facilitating behavioral interactions and influencing attitudes essential in effective teamwork. As a result, ELM may enhance safety performance by motivating subcontractors to surpass mere compliance with safety standards (via formal safety systems) to encouraging new safety initiatives (via informal safety discussions) that encourage reporting of near misses and minor events.

1.5 Case Study Analysis

The French Alternative Energies and Atomic Energy Commission (CEA) is a French public agency established in October 1945 by General de Gaulle. With 9 research centers across France, the CEA is a leader in research, development and innovation of nuclear and alternative energies.

The research focuses on two nuclear facilities (Facility A & Facility B) in different CEA research centers (Centre 1 & Centre 2). An exploratory pilot study at Centre 2 allowed an understanding of the organizational context (nuclear and subcontracting risks), the organizational configuration (flow of information, regulations and policies) and how control is exercised in this multi-dimensional organization, as well as the work environment and the operational tasks in nuclear facilities. The exploratory results from the pilot study set the context for the comparative case study of Facility A (Centre 1) and Facility B (Centre 2). Both facilities were chosen because they both perform similar activities and subcontract a significant percentage of their work but vary in size and in managerial configurations. Additionally, Facility B has twice the number of personnel as Facility A and exhibit an additional level of managerial control (hereinafter referred to as “middle management”) within the subcontracting firm.

2 Method

The research uses abductive reasoning by constantly moving back and forth between theory and empirical data [41, 42] to make sense of the observations. In addition to a close proximity and interaction with the participants of the study throughout the 8 field immersions, the researcher also had strong intervention over a period of 2.5 years with members of the organization, allowing the development of new constructs and discussion of their testability, in-line with a constructive research approach (CRA) [43].

Field immersions lasted between 3 and 10 days and allowed over 250 h of participant observation (meetings, safety procedures, training sessions, examination sessions, operations). A large quantity of empirical data was collected, including internal documents from the subcontracting firm, the CEA and correspondences with the French Nuclear Safety Authority. 31 semi-directive interviews were held with 23 participants across four managerial levels of the subcontractor-contractor entity of Facility A & B. Each interview was recorded, transcribed and analyzed and coded using n-VIVO qualitative analysis software following each data collection phase; allowing a comparative analysis of Facility A & B.

3 Results

A total of 18 categories of MCS used to prevent and mitigate safety related subcontracting risks, common to both facilities, were identified (see Table 1) across six systems levels (subcontractor, supervisor, middle management, senior CEA management within the facility, internal audit department, external regulating body). Of the MCS identified, 15 (over 80%) occurred in the senior management level and demonstrated a link to at least one influencing factors of leadership. Table 1 below categorizes all MCS into formal (behavior/output) and informal (social) controls. These categories identifying the similarities in the timing of their execution with respect to the operation: social controls (S1–S6) took place prior to operations, behavior control (B1–B8) during operations and output controls (O1–O4) after operations. The number of controls performed within each category and the frequency of those controls differed according to the managerial configuration of the facility, the level of management that executes the control and the type of department who organizes the control. Overall, Facility A employs a greater quantity of social controls indicating a more preventative nature, while Facility B places a greater emphasis on behavior controls, possibly due to its larger size, its greater emphasis of managerial presence “on-site”, and its additional level of control (middle management).

Table 1. Categorization of the 18 MCS identified in both facilities A & B into formal and informal controls (MCS that evolved in Facility B are shown in bold)

Informal controls	Formal controls	
Social controls	Behavior/process controls	Output controls
Health & safety training (S1)	Authorized access (barrier) (B1)	Performance tracking (O1)
Nuclear safety training (S2)	Authorized access (no barrier) (B2)	Tec. contamination inspection (O2)
Document management (S3)	Health & safety inspection (B3)	Radioprotection Inspection (O3)
Co-activity management (S4)	Nuclear safety inspection (B4)	Mastery of operations (O4)
Deputy roles validation (S5)	Conformity with regulations (B5)	
Health & safety exercises (S6)	Procedure validation (stopping points) (B6)	
	Facility inspection (B7)	
	Facility audit (B8)	

Modifications in the implementation of the following three social controls used in safety management were observed in Facility B, from which leadership motivations were identified as the source of these changes.

Co-activity management (S4) entails the programming of operational activities to diminish possible planning and scheduling conflict (incompatibilities where teams may operate in parallel on the same zone or require the same equipment). Co-activity meetings take place at the end of the week with senior managers and middle management to ensure minimal impediments or temporal constraints on the following week’s operations. Facility B implemented a daily co-activity meeting each morning with all staff members across four system levels, in order to include subcontractors and supervisors (not previously included in the weekly co-activity meeting) (*ELM dimension: interaction with employees, participative decision-making*).

Health & safety training (S1) is typically scheduled several times during a safety week, followed by health and safety exercises (S6) carried out without warning by the senior CEA management within the facility. Facility B has formalized this training, led by middle management, in its daily morning routine as a final “safety minute” segment of the co-activity meeting (*ELM dimension: coaching, leads by example*).

Document management (S3) procedures consist of notifying the subcontracting firm (middle management, supervisors, subcontractors) of new documents or updated versions via email and the document platform. Facility B implemented a sequence of meetings between (1) senior and middle management and (2) middle management and their subordinates (subcontractor and supervisor level) to formalize the dissemination of new documents to all members of the organization (*ELM dimension: informing*).

4 Discussion and Conclusion

The results obtained in this study provide support for the importance of applying systems-based methods to the examination of MCS as well as the value of leadership practices in safety management. This comparative study was found to be a suitable method to identify differences in management practices across two nuclear facilities in the French nuclear sector and to demonstrate that managers across all levels of the facility can provide the necessary leadership where safety is a prime strategic objective. All 18 MCS practices were mapped-out across multiple system levels, providing insight into the distance between all elements and their connection to safety leadership.

The evolution in MCS practices in Facility B provided three examples of how senior management (CEA) and middle management (subcontractors) used leadership to reinforce risk prevention in their management of safety and of human and organizational factors. These three modifications to safety management identified across several system levels within the organization suggest a new approach to transform current and future MCS contractor-subcontractor practices. By promoting the five dimensions of empowered leaders (*leading by example, coaching, participative decision-making, informing, and showing concern/interacting with employees*), that combine transactional leadership and transformational leadership, managers can detect inadequate safety behaviors or results (through MCS) and transform them using ELM principles for improved safety results. Specifically, changes in **co-activity management (S4)** (daily meeting with all staff members) *increased interactions with employs* and encouraged subcontractors to voice suggestions for daily operations, discuss contingencies in case of unexpected operational changes, thereby promoting a cohesive subcontractor-contractor entity through *participative decision making*. Such person-focused behaviors encourage new safety suggestions or initiatives and reinforce an environment to report near misses or minor events. Similarly, the formalization of daily **health and safety training (S1)** via “safety minute” led by middle management provided a communication platform to voice safety related concerns, cue safety reminders, and to identify areas that require further *coaching*. Leaders *lead by example* as they demonstrate their commitment to safety thereby re-enforcing organizational safety commitment. Finally, changes in **document management (S3)** at the senior and middle management level made a significant impact in the dissemination of information to subcontractors and supervisors, as the previous system made it virtually untraceable to determine if the documents were read (feedback was optional). By implementing a meeting with all middle management to notify them of new documents or changes to existing documents, it ensures tractability of new procedures. Next, a formal meeting where a middle manager could inform their department subordinates of these changes, ensured the dissemination of crucial safety references, and provided a time-period to voice concerns with new guidelines.

Application of safety leadership to MCS practices encourages the implementation of new ideas and initiatives while enhancing safety participation behaviors and encourages broad adoption and compliance of safety practices across multiple systemic levels of the organization. This is because safety leadership provides managers with a platform to demonstrate their commitment to safety and their concerns for employee

welfare through a more relaxed and recurrent exchange of communication compared to the harsh and less frequent examination of MCS; thereby encouraging subcontractors to adopt safety-related organizational citizenship behaviors, as a united contractor-subcontractor business entity. Overall, the formalization of the aforementioned safety controls (document management, daily health & safety training & inclusive co-activity meetings) encourages middle management to lead these changes and develop into an “ambassador” between the two firms. This additional managerial level (only present in Facility B) provides the first two systemic levels of the subcontracting firm with an initial intra-firm control. Subcontractors and supervisors feel more at ease to first evoke any safety concerns or near misses to managers within their immediate firm. Middle managers can, therefore, serve as an intermediary between subcontractors and senior management to disseminate information, encourage communication and promote safety leadership thereby promoting unity across both organizations. Application of leadership practices may help overcome the limits of MCS that arise when the controllers (senior management in over 80% of these controls identified in this study) are not present to evaluate or confirm results. As a result, a “plural leadership perspective” presents a potential method for achieving effective MCS in the ever-changing demands of the nuclear industry.

References

1. International Atomic Energy Agency: Nuclear Power Reactors in the World, Reference Data Series No. 2. IAEA, Vienna (2018)
2. Carnino, A., Nicolet, J.-L., Wanner, J.-C.: *Man and Risks: Technological and Human Risk Prevention*. Marcel Dekker (1990)
3. Perrow, C.: *Normal Accidents: Living with High Risk Systems* (1984)
4. Reason, J.: *Human Error*. Cambridge University Press, New York (1990)
5. International Atomic Energy Agency: IAEA Report on Human and Organizational Factors in Nuclear Safety in the Light of the Accident at the Fukushima Daiichi Nuclear Power Plant. IAEA, Vienna (2014)
6. International Atomic Energy Agency: *Leadership and Management for Safety*, IAEA Safety Standards Series No. GSR Part 2. IAEA, Vienna (2016)
7. Leveson, N., Dulac, N., Marais, K., Carroll, J.: Moving beyond normal accidents and high reliability organizations: a systems approach to safety in complex systems. *Organ. Stud.* **30**, 227–249 (2009)
8. Vautier, J.-F., Dechy, N., Coye de Brunélis, T., Hernandez, G., Launay, R., Moreno Alarcon, D.P.: Benefits of systems thinking for a human and organizational factors approach to safety management. *Environ Syst. Decis.* **38**, 353–366 (2018)
9. Jari Kettunen, T.R.: Safety management challenges and tensions in the European nuclear power industry. *Scand. J. Manag.* **23**, 424–444 (2007)
10. Simard, M., Marchand, A.: A multilevel analysis of organizational factors related to the taking of safety initiatives by work groups. *Saf. Sci.* **21**, 113–129 (1995)
11. Yule, S., Flin, R., Murdy, A.: The role of management and safety climate in preventing risk-taking at work. *Int. J. Risk Assess. Manag.* **7**, 137 (2007)
12. Martínez-Córcoles, M., Gracia, F., Tomás, I., Peiró, J.M.: Leadership and employees’ perceived safety behaviours in a nuclear power plant: a structural equation model. *Saf. Sci.* **49**, 1118–1129 (2011)

13. Martínez-Córcoles, M., Schöbel, M., Gracia, F.J., Tomás, I., Peiró, J.M.: Linking empowering leadership to safety participation in nuclear power plants: a structural equation model. *J. Saf. Res.* **43**, 215–221 (2012)
14. Martínez-Córcoles, M., Gracia, F.J., Tomás, I., Peiró, J.M., Schöbel, M.: Empowering team leadership and safety performance in nuclear power plants: a multilevel approach. *Saf. Sci.* **51**, 293–301 (2013)
15. Martínez-Córcoles, M.: High reliability leadership: a conceptual framework. *J. Contingencies Crisis Manag.* **26**, 237–246 (2018)
16. Flin, R.: Leadership for safety: industrial experience. *Qual. Saf. Health Care.* **13**, ii45–ii51 (2004)
17. Smith, J.A., Morris, J., Ezzamel, M.: Organisational change, outsourcing and the impact on management accounting. *Br. Account. Rev.* **37**, 415–441 (2005)
18. Das, T.K., Teng, B.-S.: Trust, control, and risk in strategic alliances: an integrated framework. *Organ. Stud.* **22**, 251–283 (2001)
19. Langfield-Smith, K., Smith, D.: Management control systems and trust in outsourcing relationships. *Manag. Account. Res.* **14**, 281–307 (2003)
20. Arnold, J.A., Arad, S., Rhoades, J.A., Drasgow, F.: The empowering leadership questionnaire: the construction and validation of a new scale for measuring leader behaviors. *J. Organ. Behav.* **21**, 249–269 (2000)
21. Zhang, X., Bartol, K.M.: Linking empowering leadership and employee creativity: the influence of psychological empowerment, intrinsic motivation, and creative process engagement. *AMJ* **53**, 107–128 (2010)
22. Reason, J., Parker, D., Lawton, R.: Organizational controls and safety: the varieties of rule-related behaviour. *J. Occup. Organ. Psychol.* **71**, 289–304 (1998)
23. Leveson, N.: A new accident model for engineering safer systems. *Saf. Sci.* **42**, 237–270 (2004)
24. Cooper, M., Finley, L.: *Strategic Safety Culture road Map*. BSMS, Franklin (2013)
25. Denis, J.-L., Langley, A., Sergi, V.: Leadership in the plural. *Acad. Manag. Ann.* **6**, 211–283 (2012)
26. Otley, D., Emmanuel, K.: *Accounting for Management Control*. Springer (2013)
27. Dekker, H.C.: Control of inter-organizational relationships: evidence on appropriation concerns and coordination requirements. *Acc. Organ. Soc.* **29**, 27–49 (2004)
28. Caglio, A., Ditillo, A.: A review and discussion of management control in inter-firm relationships: achievements and future directions. *Acc. Organ. Soc.* **33**, 865–898 (2008)
29. Eisenhardt, K.M.: Control: organizational and economic approaches. *Manag. Sci.* **31**, 134–149 (1985)
30. Ouchi, W.G., Maguire, M.A.: Organizational control: two functions. *Adm. Sci. Q.* 559–569 (1975)
31. Anderson, S.W., Christ, M.H., Dekker, H.C., Sedatole, K.L.: The use of management controls to mitigate risk in strategic alliances: field and survey evidence. *J. Manag. Account. Res.* **26**, 1–32 (2014)
32. Morsing, M., Oswald, D.: Sustainable leadership: management control systems and organizational culture in Novo Nordisk A/S. *Corp. Gov. Int. J. Bus. Soc.* **9**, 83–99 (2009)
33. Clarke, S.: Safety leadership: a meta-analytic review of transformational and transactional leadership styles as antecedents of safety behaviours. *J. Occup. Organ. Psychol.* **86**, 22–49 (2013)
34. Bass, B.M.: *Leadership and Performance Beyond Expectations*. Collier Macmillan (1985)
35. Schriesheim, C.A., Castro, S.L., Cogliser, C.C.: Leader-member exchange (LMX) research: a comprehensive review of theory, measurement, and data-analytic practices. *Leadersh. Q.* **10**, 63–113 (1999)

36. Eid, J., Mearns, K., Larsson, G., Laberg, J.C., Johnsen, B.H.: Leadership, psychological capital and safety research: conceptual issues and future research questions. *Saf. Sci.* **50**, 55–61 (2012)
37. Burns, J.M.: *Leadership*. NY (1978)
38. Bass, B.M.: Two decades of research and development in transformational leadership. *Eur. J. Work Organ. Psychol.* **8**, 9–32 (1999)
39. Kivimäki, M., Voutilainen, P., Koskinen, P.: Job enrichment, work motivation, and job satisfaction in hospital wards: testing the job characteristics model. *J. Nurs. Manag.* **3**, 87–91 (1995)
40. Katsva, M., Condrey, S.E.: Motivating personnel at Russian nuclear power plants: a case-study of motivation theory application. *Public Pers. Manag.* **34**, 343–356 (2005)
41. Dubois, A., Gadde, L.-E.: Systematic combining: an abductive approach to case research. *J. Bus. Res.* **55**, 553–560 (2002)
42. Dumez, H.: *Méthodologie de la recherche qualitative: Les questions clés de la démarche compréhensive*. Vuibert (2016)
43. Jönsson, S., Lukka, K.: There and Back Again. Doing Interventionist Research in Management Accounting. *MAR Handbook* (2006)



Work in the Age of Artificial Intelligence – Challenges and Potentials for the Design of New Forms of Human-Machine Interaction

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Abstract. In times of digital transformation, enterprises are facing great challenges in terms of management and work organization. In particular, the rapid progress in the field of artificial intelligence and cognitive systems requires a rethinking of by whom and how work activities will be carried out in the future. The automation of routine processes and intelligent algorithms in some cases even allow new approaches and perspectives. For not only machines or intelligent algorithms are going to execute tasks, new forms of human-machine interaction represent valuable enablers of positioning the central role of humans. Therefore, it does not only require technological but also cultural development. By using new technologies and methods, tasks and jobs will change in the future: qualification requirements will transform, previous jobs will be lost and new job profiles will emerge. The demand for highly qualified staff will greatly increase. Especially digital competence will be in more demand than ever as will be the ability to control complexity and human creativity. Nevertheless, how to get there and how to create the missing socio-technological link? In this paper, the authors present selected currently available technological solutions in the field of artificial intelligence leading to new forms of human-machine interaction. In addition, the authors point out future demands on the skills of both employees and managers as well as appropriate training opportunities.

Keywords: Artificial Intelligence · Collaboration · Data · Digitization · Human-Machine interaction · Organization · Performance · Skills · Technology

1 Introduction

Although having been studied for decades Artificial Intelligence (AI) is still one of the most elusive subjects in Computer Science. This partly due to how large and nebulous the subject is [1]. Looking at the history of AI with logic-based approaches in the 1950s and early 60s, knowledge-based expert systems in the 1970s and 80s, and data-driven approaches from 2000 onwards high expectations have repeatedly given way to periods of disillusionment and reduced funding in-between. Nowadays, breakthroughs in particular result from the convergence of increased computing capacity, availability of data, and new algorithms [2].

For AI does not only have to be seen as a technology, but also as a scientific discipline with far-reaching consequences for the global economy and society, researchers and institutions from the private and public sector continuously are striving to sharpen the understanding and to generate a shared common knowledge. With intelligence – both of human and machines – still being a complex and quite vague concept the European Commission’s High-Level Expert Group on Artificial Intelligence proposes the following definition for AI systems [3]: “AI refers to systems designed by humans that, given a complex goal, act in the physical or digital world by perceiving their environment, interpreting the collected structured or unstructured data, reasoning on the knowledge derived from this data and deciding the best action(s) to take (according to pre-defined parameters) to achieve the given goal. AI systems can also be designed to learn to adapt their behavior by analyzing how the environment is affected by their previous actions” (Fig. 1).

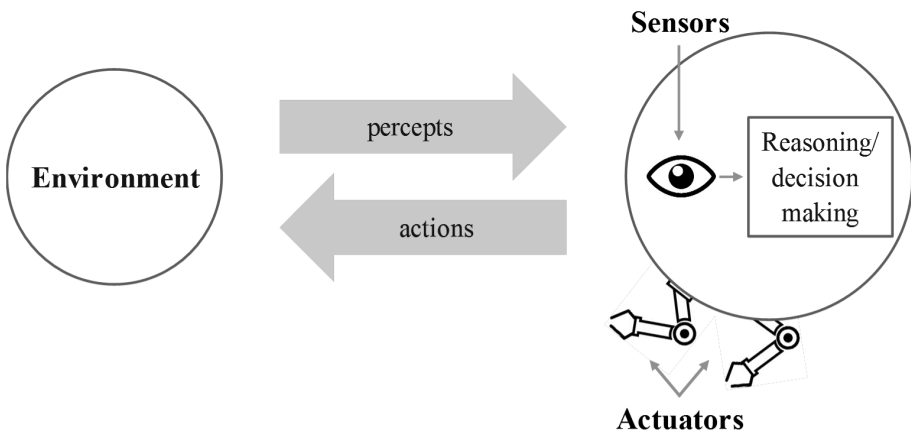


Fig. 1. Schematic depiction of an AI system [3]

As an essence, AI in this way endows computer programs with cognitive functionalities enabling entirely new business models and work processes. In addition to the nature and performance of cognitive systems, especially the question of the design of new forms of human-machine interaction in this context will arise in the future.

2 Application Areas and Technologies of AI Systems

Technical systems with AI are becoming increasingly important in many areas of our economy and society – not only because of their constantly increasing technical performance, but above all because of their ability to develop continuously and independently by adapting to new environments. Accordingly among many others, a survey of 818 members of the German VDI with 56% approval showed, that AI is currently the biggest trend in IT [4]. A large number of new use cases and concrete business models based on AI technologies in enterprises across all industries also confirm this

estimation. As the following examples illustrate, AI thus offers transformational possibilities for customers and enterprises due to the closer cooperation between human and machine as well as the increasing practicability of the technology [5]:

- Automotive industry: autonomous fleets for carpools, intelligent cars/driver assistance, predictive and autonomous maintenance.
- Energy: smart metering, more efficient grid operation and storage, smart infrastructure maintenance.
- Financial services: personalized financial planning, fraud detection and anti-money laundering, transaction automation.
- Healthcare: data based diagnostic support, pandemic detection, image diagnostics (radiology, pathology).
- Manufacturing: increased monitoring and automatic correction, supply chain and production optimization, on-demand manufacturing.
- Retail: personalized design and production, customer experience building, inventory and supply management.
- Technology, communication and entertainment: media archiving and search, content creation, personalized marketing and advertising.
- Transport and logistics: autonomous transport and delivery: traffic regulation and congestion avoidance, improved safety.

An extended overview of the technologies and functions that make up what we now call AI in their interaction provides Kristian Hammond's periodic table of AI [6]. Hammond considers AI to be the combination of basic elements, similar to different LEGO[®] bricks. Each AI element represents a sub-function that has historically established itself as an encapsulated functionality of a certain complexity and power. The author defines 28 AI elements combinable according to general criteria. Each AI element falls into one of three groups, namely "Assess" (for example, to record the traffic situation around a robot car in milliseconds), "Infer" (for example, calculate the probability of a rear-end collision for the next three seconds) and "Respond" (for example, initiate the braking or evasive maneuver of the robot car). The selection of at least one AI element from each group thus – as an "AI element triple" – represents the typical processing step of an application case driven by AI. The assignment of the selected AI elements to the three groups is as follows:

- Group "Assess": speech recognition (Sr), audio recognition (Ar), face recognition (Fr), image recognition (Ir), general recognition (Gr), speech identification (Si), audio identification (Ai), face identification (Fi), image identification (Ii), general identification (Gi), data analytics (Da), text extraction (Te).
- Group "Infer": predictive inference (Pi), explanatory inference (Ei), synthetic reasoning (Sr), planning (Pl), problem solving (Ps), decision-making (Dm), language generation (Lg), language understanding (Lu).
- Group "Respond": relationship learning (Lr), category learning (Lc), knowledge refinement (Lt), mobility large (MI), mobility small (Ms), manipulation (Ma), communication (Cm), control (Cn) (Fig. 2).

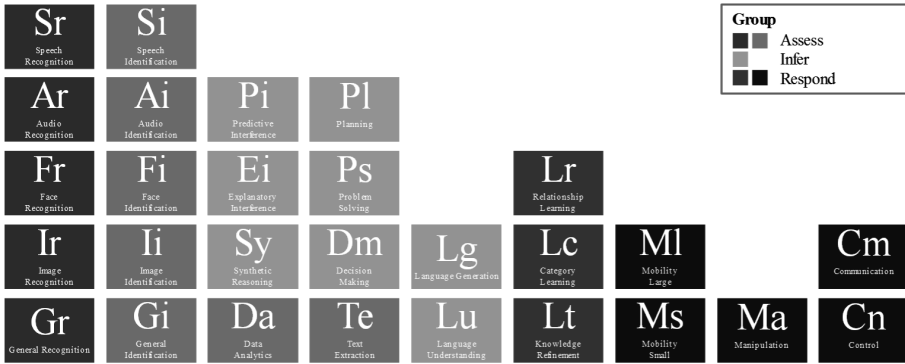


Fig. 2. Periodic table of Artificial Intelligence [6]

The periodic table of AI helps to reflect systematically on the purposes, opportunities and risks of AI without getting lost in discourses about their technical implementation. It helps, for example, to identify plausible applications for digitization, to compare offers from different providers or to keep an eye on the organizational consequences of AI moving into enterprises [7].

According to a current Lünendonk[®] survey among 130 CDOs, CIOs and IT managers from large enterprises and corporations, the use of language assistants (68%) is currently the most common, for example, for IoT business models such as smart home components or chatbots for customer interaction. The second most important AI technology level are solutions for the automation of business and IT processes (62%) followed by predictive analytic tools as an add-in within business intelligent solutions (58%), as an example of fraud detection or customer segmentation. Classic predictive analytics tools already have forecasting models to evaluate the future. However, these tools reach their limits particularly finding anomalies in huge databases (e.g. credit databases, sensor data) hidden from the human eye. For example, AI tools here shall support the detection of anomalies or patterns in large databases and the early detection and correction of process disturbances [8].

At this point it should be noted, that two central cognitive functionalities are “learning”, to automatically construct models, facts, and knowledge that accurately capture some aspect of a real or virtual phenomena from observations, assumptions, prior knowledge, and interactions with the environment, and “reasoning”, to draw valid conclusions from models, facts, observations, assumptions, and knowledge. AI systems in the future will be able to perform certain tasks automatically. However, there will still be a need for human-machine interaction due to technological restrictions. Thus, AI systems are able to recognize correlations of certain developments, but these often do not lead to goal-oriented insights due to non-existent causalities. At this point humans are still superior to machines because of their competence to judge and experience.

3 Impact of AI on Future Business and Work

According to forecasts, AI can additionally increase global gross domestic product (GDP) by an average of 1.2% points per year by 2030. AI thus exceeds the annual growth effect achieved by steam engines (0.3% points), industrial robots (0.4% points) and the spread of information and communication technologies (ICT, 0.6% points). In total, AI can make an additional global contribution to value creation of 13 trillion US dollars by 2030 [8]. Enterprises in all industries are therefore encouraged to consider the effective use of AI in order to exploit the potential of AI fully – and this awareness seems to have matured in enterprises, as the CEO’s perspective of AI’s impact on business strategy expresses [5]:

- 72% of CEO’s believe AI will be the key business advantage of the future,
- 67% believe AI will have a positive impact on the business by combining artificial intelligence with human intelligence,
- 54% confirm that AI has already increased productivity in their enterprises.

In this context, both strategic and operational objectives are of importance to enable efficiency in processes and customer centricity primarily (Fig. 3):

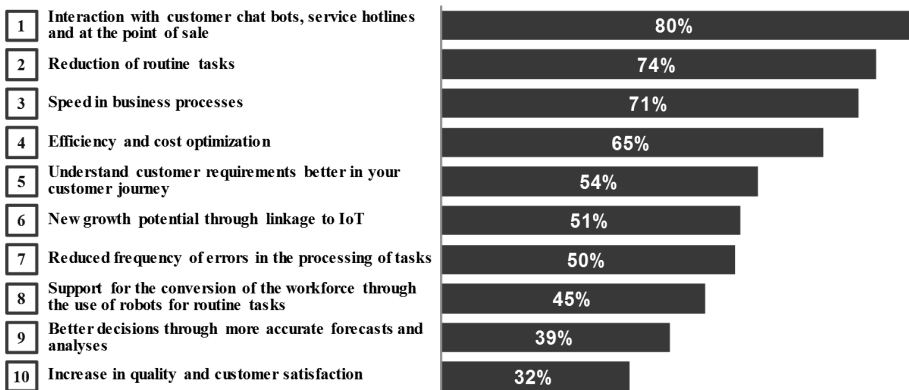


Fig. 3. Business opportunities of AI [8]

With regard to the division of labor between humans and machines, the spectrum of AI – besides automation of repetitive manual and cognitive tasks by machines – consists of three general areas [5]:

- Assisted intelligence: already widespread improving what people and organizations are doing today,
- Augmented intelligence: developing now allowing people to do things that they would otherwise not be able to do,
- Autonomous intelligence: developed for the future creating machines that act independently (Fig. 4).

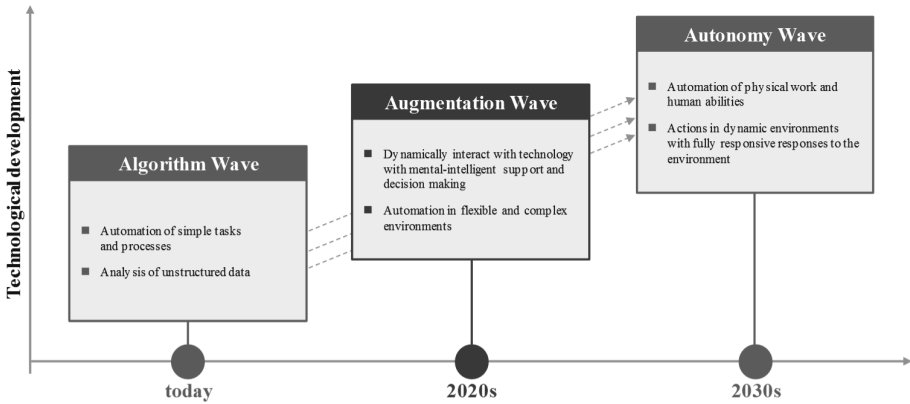


Fig. 4. Three waves of the current and upcoming AI [5]

Since, historically speaking, any innovation that makes the capital factor production more productive also has a direct or indirect impact on labor, AI will also have a significant impact on occupations and activities – mainly through three channels [10]:

- Replacement of human work: complete takeover and performance of activities by machines even in constantly changing environments,
- Increased efficiency through intelligent input: replacement of processes that support the actual creation of value on the basis of intelligent algorithms,
- New tasks for enterprises and employees: creation of new value-adding processes due to the execution of standardized tasks by computer programs and machines.

The results of a recent Fraunhofer IAO study on the effects of AI on future work and the division of labor between humans and machine over the next five years, confirm that simple and analytical activities in the field of data analysis in particular will be most affected by automation. In contrast, empathic activities, for example the recognition and processing of emotions, as well as intuitive activities, such as creativity and independent adaptation, will continue to be the primary responsibility of humans in the future. Comprehensive shifts in work organizations and techniques currently especially emerge in the field of knowledge work [11].

Here AI-supported automation in particular can contribute to relieve people of routine activities and to support knowledge-intensive activities to promote productivity and innovation, for example by automated data collection and analysis, development of hypotheses as well as creation of models and their verification. On the other side, enterprises that deploy advanced AI systems will need a cadre of employees who can explain the inner workings of complex algorithms to nontechnical professionals [12]. According to this, an Accenture global study of more than 1.000 large enterprises identified the emergence of three new categories of uniquely human jobs (Fig. 5):

TRAINERS	<p>Customer-language tone and meaning trainer</p> <p>Smart-machine interaction modeler</p> <p>Worldview trainer</p>	<ul style="list-style-type: none"> • Teaches AI systems to look beyond the literal meaning of a communication by, e.g. detecting sarcasm. • Models machine behavior after employee behavior so that, e.g., an AI system can learn from an accountant’s actions how to automatically match payments to invoices. • Trains AI systems to develop a global perspective so that various cultural perspectives are considered when determining, e.g., whether an algorithm is “fair”.
EXPLAINERS	<p>Context designer</p> <p>Transparency analyst</p> <p>AI usefulness strategist</p>	<ul style="list-style-type: none"> • Designs smart decisions based on business context, process task, and individual, professional, and cultural factors. • Classifies the different types of opacity (and corresponding effects on the business) of the AI algorithms used and maintains an inventory of that information. • Determines whether to deploy AI (versus traditional rules engines and scripts) for specific applications.
SUSTAINERS	<p>Automation ethicist</p> <p>Automation economist</p> <p>Machine relations manager</p>	<ul style="list-style-type: none"> • Evaluates the non economic impact of smart machines, both the upside and downside. • Evaluates the cost of poor machine performance. • “Promotes” algorithms that perform well to greater scale in the business and “demotes” algorithms with poor performance.

Fig. 5. Representative roles created by AI [11]

Within a survey of 607 enterprises, including large enterprises, start-ups and small and medium-sized enterprises, the Stifterverband für die Deutsche Wirtschaft e.V. in cooperation with McKinsey & Company identified the need for new technological skills for 700,000 German employees over the next five years. Accordingly, enterprises should provide further training in 18 skills in the following three fields of competence: Technological skills, basic digital skills and classical skills:

- Technological skills: complex data analysis, smart hardware/robotics development, web development, user-centric design (UX), conception and administration of networked IT systems, blockchain technology development, tech translation,
- Basic digital skills: digital literacy, digital interaction, collaboration, agile working, digital learning, digital ethics,
- Classical skills: problem-solving ability, creativity, entrepreneurial action and initiative, adaptability, stamina.

In order to achieve these ambitious plans, targeted recruitment of graduates in the sought-after subjects, recruitment on the global labor market or the targeted establishment of technology activities at talent hotspots as well as further qualification of existing staff and teaching of technological skills are essential.

Overall, the findings presented and the resulting challenges with regard to employability make it clear that people will also play a leading and shaping role in the future world of work enriched by AI systems.

4 Conclusions and Demand for Further Research

Artificial Intelligence as technology and scientific discipline leads to a profound change in the world of work. On the one hand, AI systems offer enterprises a wide range of options for making processes more efficient and economical. On the other hand, the selection of suitable AI technologies and functions for the concrete use case and the

question of new forms of human-machine interaction confront enterprises with great challenges:

- The use of AI requires an advanced stage of digitalization or digital readiness in enterprises.
- AI systems require a combination of different AI technologies and functions to generate purpose-oriented and tailor-made solutions.
- The use of AI creates new activity profiles for the understanding and use of AI systems requiring corresponding competencies.
- The design potential to relieve employees of routine activities and to support knowledge-intensive activities to promote productivity and innovation has to be identified.
- An integrated design of the AI technology and process and activity dimension of the work system is necessary for a productivity- and competence-promoting human-centric introduction of AI.

Summing up we can conclude, that coupling capabilities of cognitive systems and humans enables enterprises to achieve competitiveness within the rapid change of a hybrid world. Even though incorporating AI into business systems and processes is a journey unlike any other digital technology implementation its use is about the support of humans and not about the dominance of technology over people. For this reason, our further research work will be carried out on a methodology for the identification of application potentials of artificial intelligence and the establishment of new forms of human-machine interaction for the design of new innovation processes.

References

1. McGuire, B., Huang, T., Smith, C., Yang, G.: The history of artificial intelligence, history of computing CSEP 590A. University of Washington (2006)
2. Craglia, M. (Ed.), Annoni, A., Benczur, P., Bertoldi, P., Delipetrev, P., De Prato, G., Feijoo, C., Fernandez Macias, E., Gomez, E., Iglesias, M., Junklewitz, H., López Cobo, M., Martens, B., Nascimento, S., Nativi, S., Polvora, A., Sanchez, I., Tolan, S., Tuomi, I., Vesnic Alujevic, L.: Artificial intelligence – a European perspective, EUR 29425 EN, Publications Office, Luxembourg, ISBN 978-92-79-97217-1, <https://doi.org/10.2760/11251>, JRC113826 (2018)
3. The European Commission’s high-level expert group on artificial intelligence: a definition of AI: main capabilities and scientific disciplines, Brussels (2018)
4. VDI Verein Deutscher Ingenieure e.V.: VDI-Statusreport “Künstliche Intelligenz”, Düsseldorf (2018)
5. PricewaterhouseCoopers GmbH Wirtschaftsprüfungsgesellschaft GmbH: Künstliche Intelligenz als Innovationsbeschleuniger in Unternehmen – Zuversicht und Vertrauen in Künstliche Intelligenz, Stuttgart (2018)
6. Hammond, K.: The Periodic Table of AI (2016). <https://ai.xprize.org/>
7. Bundesverband Informationswirtschaft, Telekommunikation und neue Medien e. V (Bitkom e.V.): Digitalisierung gestalten mit dem Periodensystem der Künstlichen Intelligenz – Ein Navigationssystem für Entscheider, Berlin (2018)

8. Lünendonk & Hossenfelder GmbH: Relevanz von künstlicher Intelligenz für große Unternehmen, Sonderanalyse zur Lünendonk[®]-Studie: Der Markt für IT-Beratung und IT-Service in Deutschland, Mindelheim (2018)
9. Bughin, J., Chui, M., Joshi, R., Manyika, J., Seong, J.: Notes from the AI Frontier – Modeling the impact of AI on the world economy, McKinsey Global Institute, Brussels, San Francisco, Shanghai, Stockholm (2018)
10. Heinen, N., Heuer, A., Schautschick, P.: Artificial intelligence and human labour implications for companies and economic policy, *Wirtschaftsdienst* (2017) 97: 714. <https://doi.org/10.1007/s10273-017-2203-5> (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, 2017
12. Wilson, H.J., Daugherty, P.R., Morini-Bianzino, N.: The jobs that artificial intelligence will create. MIT Sloan Management Review (2017)
13. Stifterverband für die Deutsche Wissenschaft e.V.: Future Skills: Welche Kompetenzen in Deutschland fehlen (Diskussionspapier), Essen (2018)



Leadership and the Human Factor in an Enterprise Providing Services to the Polish Armed Forces

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Abstract. The article presents the results of the initial assessment analysis of the role played by the personnel in aircraft repair services that provide repairs to the Polish army and other armies. This entity is not militarized, but it implements processes that constitute the value creating chain, where the military stages are included. The crew is formed by civilians who act on behalf of the military and on military equipment. Such employees must function within a strictly defined military processes and are subject to many military procedures. There is little or no space for activities not specified by the regulations. The repair plants have a quality management system that stimulates creative activities; hence the employees must confront their creativity with strict adherence to military procedures, where there is little room for creativity and a creative approach. The analysis presents the results of observations and interviews with the crew, the purpose of which was to identify the expectations of staff and management as regards the role of the human factor in formalized paramilitary processes.

Keywords: Military enterprise · Human factor in military processes · Repairs of military aircraft repairs

1 Introduction

The subject of this article is the paradox related to the role of employees in a civilian enterprise working exclusively for military purposes. A study carried out by the SYDYN research group identified the attitudes presented by employees and management of a specific enterprise being a part of the Polish Armaments Group. Its personnel does repair works of combat aircraft for the Polish army and other armies and for that reason they are subject to very strict rules resulting from military procedures. On the other hand, employees use this opportunity to develop and improve their processes as part of the quality management system. Creativity is a desirable feature in almost every professional activity performed by humans, however, in the discussed entity, it is a subject to quite heavy restrictions due to the clients' requirements [1].

Despite the fact that the crew performs strictly defined repair procedures and operates under the conditions of the technological and legal regime set by the

documentation of aircraft and regulations, one can notice an interesting phenomenon related to the attitudes the employees present. They are vividly interested in the role they play in the value creation chain, and the management is interested in the psychosocial mechanisms-related impact they can have on the crew. These conditions allow to reveal the significant impact of the human factor on the effectiveness of the service processes. Despite the military rigor in the processes, both the management and the crew are interested in their influence the technical aspects of the processes they carry out as well as in the behavioural element of the social subsystem functioning. This is especially noticeable when the efficiency and effectiveness of this system are analysed.

2 The Specifics of the Operation of Aircraft Repair Plants

The Military Aviation Works located in Lodz (Poland) have a long and significant aviation - related tradition. Thanks to the cooperation with the Lodz University of Technology, they have access to knowledge bases and databases of the academia that can be used to recruit both the lower and higher level staff, which is an important asset. The staff is characterized by great attachment and loyalty to the company.

The Military Aviation Works operates in the aviation industry; its basic scope of operations is to perform major repairs, modernization and servicing of aircraft and their equipment. Their main strategic objective is to perform economic activities in the sphere of logistic security of Polish military aviation [2]. Adjustments of internal organizational structures, modifying and modernizing technological potential and maintaining the appropriate level of staff competence allow to create the base for efficient and optimal management of owned resources [3]. These activities are supposed to maintain continuous organizational and technological compatibility with the structures of Polish military aviation, in pursuit of realizations of tasks that result from the changing needs of military aviation. They are also meant to provide conditions for undertaking new technologically advanced tasks.

The plant is aiming to be a modern, constantly developing company, ensuring high operational efficiency of the aircraft fleet owned by the Armed Forces of the Republic of Poland that would satisfy both customers and employees [4].

Military Aviation Works operate as a part of a commercial company, which gives significant opportunities when it comes to realization of purchase. Cooperation with organizations that are part of governmental structures allows to use this area to formulate competitive offers. Organizations that belong to the public sphere are obliged to use time-consuming public procurement procedures. Acting as a commercial company, Military Aviation Works are able to make purchase faster and without restrictions resulting from financial plans of the budget sphere. The right to make independent purchase abroad is also an important area, related to the possession of an Internal Special Trade Control System with foreign countries. This creates opportunities for commercial mediation in the supply of armaments and dual-use goods for organizations from the public sphere. This creates opportunities for commercial mediation in the supply of armaments and dual-use goods for organizations from the public sphere and the competitiveness of production offers related to the possibility of using cooperation with foreign partners without intermediaries.

The versatility of the renovation and production activities, including areas related to aircraft is definitely an asset that contributes to competitive advantage. This kind of versatility of aviation-related activities is unique among both the companies belonging to the Polish Armaments Group and other entities that are competitive and independent. A positive element is targeting and profiling of activities of individual subsidiaries by the Polish Armaments Group, which allows to avoid unnecessary competition and directing resources to the Military Aviation Works.

In the area of military aviation, the stakeholders are military supply authorities from all levels and direct users of aviation military equipment, along with their commanders at all levels of hierarchy. Other important stakeholders are the Ministry of National Defence and the Polish Armaments Group along aviation industry entities subordinate to it, which performs corporate governance over Military Aviation Works. As regards the supervision of the quality of products for military purposes, an important stakeholder is the Military Center for Standardization, Quality and Codification with the Regional Military Representatives governed by it. The basic expectation of all these interested parties is to ensure efficient, effective and safe functioning of Polish military aviation.

3 Organization of Performed Works

The repair plants are primarily doing main repairs, maintenance and modernization of aircraft for the armed forces. In case of major repairs, the process involves all production departments and organizational units related to purchases, technological service, and planning of repair works. Aircraft servicing is carried out at individual production departments. Depending on the scope of needed service, the organizational units involved in the process may be related to purchase, technological support and maintenance planning. Modernizations of aircraft are carried out at the airframe department. The technology department is the one mainly involved in the process, with support of other organizational units.

4 Organization of the Course of Work

The Military Aviation Works plan and manage the course of works in an orderly and supervised manner, taking into account factors such as:

- customer requirements,
- internal organization,
- limitations and possibilities of resources,
- time limits
- risk levels

Managers of all ranks involved in the implementation of the project are obliged to plan and implement it in an orderly and controlled manner, taking into account the current availability of resources and compliance of the implementation process with the project schedule.

Basing on contracts and arrangements with customers, an annual quantitative and assortment plan is prepared, that specifies production plans for a given calendar year.

This plan is updated during the year and is the basis for production planning in individual production departments.

When planning the realization of the main repairs, servicing and modernization of aircraft, the following factors are taken into account:

- product requirements:
 - personnel safety,
 - product safety,
 - production capabilities,
 - control capabilities,
 - product reliability,
 - availability of materials, parts and components,
 - suitability of used materials and parts,
 - aging processes of the product,
 - prevention, detection and removal of foreign objects,
 - rules of handling the product,
 - storage of the product,
 - recycling or final disposal of the product at the end of its lifecycle.
- defining criteria processes applied,
- defining criteria for sign-off for the work already performed,
- identification of the resources needed to achieve compliance with the requirements for the work performed,
- identification of resources needed to ensure timely execution of works,
- implementation of supervision of processes, in accordance with relevant criteria,
- defining, maintaining and storing documents to necessary to demonstrate compliance of the performed works with the requirements,
- defining processes and governance necessary to manage critical elements,
- involvement of functionaries representatives in planning and governance,
- determination of processes and resources to support the use and servicing of aircrafts,
- defining governance measures to prevent non-compliant products from being delivered to the customer.

Other processes that support the realization of performed works are co-ordinated by managing current decisions effectively. The elements related to the execution of planned realizations and supporting processes achieve their effectiveness through appropriate management in particular phases of their implementation at specific departments and organizational units.

Projects related to production processes are planned basing on data obtained from the contracts signed with the customer. Information on the manner of project realization agreed with the customer is sent as an internal order to production departments and organizational units, where implementation schedules are developed for individual projects, with attention paid to customer-defined limitations resulting from legislation and internal procedures.

The purpose of these activities is to meet the requirements for the execution of work within the deadlines specified in the schedule, considering any possible restrictions on available resources.

The employees of the Quality Control Department allow to use aircraft after checks and acceptance tests in accordance with the inspection plans adopted for these aircrafts and on confirmation of compliance with the maintenance scope specified in technical documentation and relevant registration forms (circular technical documentation, certificates metrics, etc.). These activities are carried out in a planned manner at appropriate stages of the main repair, maintenance or modernization.

The determination, approval, supervision and application of repair schedules is performed by personnel responsible for customer complaints, in consultation with personnel responsible for production processes, purchasing, technological and construction supervision. Quick and efficient preparation of teams directed to perform repairs on customer's premises or at another designated location makes it possible to ensure appropriate repair schemes and appropriate provision of these teams in materials, parts, subassemblies, tools and production equipment as well as data necessary to effectively remove product non-conformities to the requirement. If the problems are identified after delivery, the complaint teams carry out the analysis and present reports on performed activities and drawn conclusions.

5 The Human Factor

Due to special conditions of the specificity of aircraft repairs performed in repair plants providing services to the Polish Armed Forces, an essential element of the management approach is the possession and access to necessary resources, both intangible and tangible. Among the issues that determine the effectiveness of management in these enterprises, the human factor is significantly important. It is related to, among others, the psychological and sociological sphere of the company activity. It requires established cooperation between the organizational units of the company and specified unambiguous and formal relationships between them. If the employees are expected to perform highly skill-demanding and good quality tasks in the company, it is necessary for them to show wide competences, abilities, experience and continuous training and improvement [5]. Only this approach ensures excellent quality of the main repairs and an appropriate level of safety in the subsequent operation of aircraft in military units.

In management engineering, the human factor is treated as a factor creating organizational structures. It consists of individuals and groups of those people in organizations that perform duties and tasks resulting from their functions as well as aspirations and goals designated to be achieved. By identifying the human factor in aircraft repair processes, it should be noted the primary importance of a human being in successful and effective implementation of the company's objectives and the importance of personnel in ensuring compliance with the requirement for the quality of the repair or service. This also applies to employees who are not directly involved in production (i.e. those dealing with purchases, planning, and contacts with customers). It should be remembered that every employee has some influence on the functioning of the repair plant. In terms of resources, the human factor should be treated as a component of the economic value of the organization [6].

The success of any undertaking depends on the people who take part in it. For example, changes taking place in the structure of the management process of the

discussed enterprise are to a large extent based on the emotions of people participating, especially when the flow of information is inadequate to the needs. In such case, in order to be effective, access to the necessary knowledge should be ensured. Undoubtedly, information is an important factor in the effectiveness of undertaken actions, determining changes in the organization. In repair plants providing services to the Armed Forces, the human factor is responsible for the entire process of the main repair of the aircraft. It is also responsible for the customer (a military unit in this case). Due to this, the correct flow of information is very important both at the external company-customer level as well as at the internal level of 'faculty - department' or 'employee-employee' [7]. We can speak here about both external and internal customers (the latter understood as employees of the organization).

The human factor is an important criterion for the enterprise management system governance. Its importance manifests itself at every stage of building and updating the structure of this system, i.e. in:

- the design phase, by clearly defining the qualifications and competences of people participating in the system, which are a guarantor of the effective functioning of the organization and the system,
- the implementation phase, in which it is important to convince potential adversaries about the need for changes,
- the maintenance and improvement phase, which is a determinant of the correctness of previously taken decisions, also regarding the allocation of competent and competent powers to perform specific tasks for employees.

The need for change related to ensuring the effectiveness of the organization's functioning is determined by the possibilities of adapting to- and accepting these changes by the company's personnel. To ensure the effectiveness of the system, it has been necessary and to counteract potential difficulties and irregularities that appear during the changes. This requires adequate access to information, understanding of the scope of the changes and acceptance of their root causes, including the authors of the proposed changes. Employees articulate the need to influence what is going on around them. Despite a much formalized approach to processes due to the fact that they concern military aviation, the need to be aware of changes is clearly visible. In the activities undertaken by the employee, the important elements are: the vision (the answer to the question where we are going and what we want to achieve), the plan (a clearly defined way of achieving the goal) and resources (access to necessary resources that make change possible) and the motivation of people to move away from the existing state of things [8].

Employees with their qualifications declare that they are an important element of the company's resources, allowing to achieve the planned goals, and actually conditioning success. Among the important factors of influence highlighted by employees, it is important to actively engage the management of all ranks and active participation of the crew, not due to profession-related coercion, but out of beliefs about their role and significance [9]. At the same time, it requires constant efforts to improve the efficiency of resource management and the effectiveness of achieving and harmonious combination of objectives important for the enterprise, its customers, employees and other entities involved in the process.

To ensure effective functioning of the company, it is important to account for the right interpersonal relations in the organization. According to the thesis that is developed within the framework of industrial psychology, material stimuli are important for employees' reactions, but the social context of the consciously performed work is equally important. The presented organization is not a military unit, but it works for the military and not only for the Polish one. Therefore, the work regime and the existing codes of conduct are subject to military rules. In spite of this, employees know their role in the entire process, because they function within the quality management system, in which the roles in the value-adding chain have been very well defined [10].

The work allows for satisfying variety of needs, from the physiological ones to social needs, the needs of recognition and self-realization. One of the concepts clarified in this direction (the so-called behavioural school) assumes a holistic view on the effects of interpersonal behaviours and their determinants. The behavioural school recognizes a person as a particularly important resource of an enterprise, along with phenomena that describe this person, i.e. job satisfaction, stress, motivation, leadership, group dynamics, conflict mechanisms, business relations, innovation, skills, etc.

The condition for proper functioning of the management system is the provision of resources necessary for its maintenance and improvement [11]. Among all resources in aviation plants, human resources are of particular importance, which determine the possibilities of the company in the field of tasks realization and customer expectations.

6 Conclusion

The human factor is important both in terms of internal and external development opportunities of the enterprise. Thus, it can be considered at various levels of the organization's functioning and in terms of different degrees of impact of the environment on the possibilities of this functioning, especially in terms of the specificity of repair plants providing services to the Armed Forces - repairs of major aircraft. It is an important criterion for the effectiveness of meeting the needs and expectations of customers. It is the scope of the system and the enterprise that determines the possibilities of its development. Therefore, a long-term enterprise development strategy cannot disregard the human factor. It seems that the level of enterprise excellence is demonstrated by the technological level, however, it is the employees who determine the quality of the processes carried out. Proper technical equipment is a prerequisite for an adequate level of service, but it is not a sufficient condition. In the process of enterprise development, in which the essential stage is introducing changes, the person must accept the proposed changes and then, by specifying their scope, affects the efficiency of the introduction. The crew and the level of its competences, expectations, ambitions and commitment determine directly the position of the company against competition and indirectly determines the position of the army on the battlefield. In a situation where the reaction of a company depends on changes taking place in its environment, a person becomes a particularly important factor related to its proper functioning. The purchase of increasingly more modern technologies, machines along with efficient process management not enough to increase its efficiency. In the conditions specific to aircraft repair plants that provide services to the Armed Forces,

employing qualified employees willing to improve equals greater opportunity to obtain new orders, fewer complaints - greater profit, and as a result, a better position of the company both on the market and in the eyes of current and future customers [12].

Both the personnel and the management know the role that people play in such highly formalized and responsible processes. From the research an image emerges of an employee who knows how much depends on the person doing the job: responsibility for the safety of the aircraft, and what follows - of the country. It is also an employee who is aware that the technical subsystem is only a tool available to the employee. Therefore, employees show pride in the role they play, but at the same time a huge responsibility for the effect of the service. Therefore, it can be stated that they manifest an extraordinary awareness of their role as a human factor determining the quality of army aircrafts.

References

1. Wisniewski, Z.: Wdrażanie zarządzania jakością w przedsiębiorstwie produkcyjnym - uwarunkowania i bariery. Lodz University of Technology, Lodz (2002)
2. Kozłowski, R.: Technology innovation for logistics service providers. In: *New Challenges in Change Management*, pp. 131–148 (2018)
3. Wrobel-Lachowska, M., Wisniewski, Z., Polak-Sopinska, A.: The role of the lifelong learning in logistics 4.0. *Advances in Intelligent Systems and Computing*, vol. 596, pp. 402–409 (2018)
4. Galinska, B.: Intelligent decision making in transport. Evaluation of transportation modes (types of vehicles) based on multiple criteria methodology. *Advances in Intelligent Systems and Computing*, vol. 844, pp. 161–172 (2019)
5. Bielecki, M., Hanczak, M.: Evaluation of aspects of logistics efficiency of a product in the production enterprise. In: *International Conference on Industrial Logistics, ICIL 2014*, pp. 24–31 (2016)
6. Maczewska, A., Polak-Sopinska, A., Wisniewski, Z., Krason, P.: The concept of teaching modeling and simulation of manufacturing systems. *Advances in Intelligent Systems and Computing*, vol. 792, pp. 87–96 (2018)
7. Szymonik, A., Bielecki, M.: Safety of logistics systems as an element of the total logistics management concept. In: *International Conference on Industrial Logistics, ICIL 2014*, pp. 121–126 (2014)
8. Bielecki, M., Szymonik, A.: The impact of logistics security conditions on the logistical efficiency of the product. In: *International Conference on Industrial Logistics, ICIL 2014*, pp. 115–120 (2014)
9. Stankiewicz-Mroz, A.: Approach to the issues of leadership in the processes of companies' acquisitions. *Procedia Manuf.* **3**, 793–798 (2015)
10. Wisniewski, Z., Blaszczyk, A.: Changes in maintenance management practices – standards and human factor. *Advances in Intelligent Systems and Computing*, vol. 606, pp. 348–354 (2018)
11. Wisniewski, Z., Mnich, J.: A change of approach to management from the functional to the process one – a human factor and an administrative factor in a public university. *Advances in Intelligent Systems and Computing*, vol. 605, pp. 164–170 (2018)
12. Galinska, B.: Multiple criteria evaluation of global transportation systems - analysis of case study. *Advances in Intelligent Systems and Computing*, vol. 631, pp. 155–171 (2018)



Productive Process Improvement at Automotive Wire Harnesses Enterprise Through Work Teams

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Abstract. This study objective is to increment efficiency in secondary process at automotive wire harnesses enterprise, through distribution change into the workstations, performed by work teams. Was analyzed each process area; then, manufacturing flows were defined; each common workstation among families was identified to place them into common area, workstations were rebalanced, densification and simulation techniques were applied.

Steps followed: Manufacturing Flows Improvement: To identify common workstations; were proposed centralized processes; value chain mapping is the best tool, in this case. Workstations rebalancing: similar workstations are identified, also workloads for each station, and production daily volume required; rebalancing should consider one route to deliver each component to each line and workstation where is used. Workstations area distribution design: was selected distribution by process or by function. Result analysis, efficiency results doesn't show positive results, because were launched new part numbers simultaneously to changes implementation. Productivity changed from 81.77% to 93.59%.

Keywords: Productive processes improvement · Automotive wire harnesses · Workstation densification · Work area distribution · Work teams

1 Introduction

This study objective is to increment efficiency in a secondary process at an automotive wire harnesses enterprise, through a distribution change into the workstations distribution, performed by work teams. To develop the new workstations distribution, each process area was analyzed, among them, terminal bench presses, components assembly, sleeve heaters; after that, were defined manufacturing flows for each wire harnesses family; next step, each common workstation among families was identified to cheer and to place them in a common area, accordingly to manufacturing flow established.

After workstations are known, next step was to rebalance each station workloads to eliminate workstations, and look forward improvement opportunities. To perform workstations location change, it was used a guide that contemplates areas divided by

blocks and aisle size defined, covering material service and maintenance routes, to establish necessary room for manufacturing processes, densification.

Knowing manufacturing flows variables and stations workloads, it was defined each station position in secondary processes area of high voltage section at automotive wire assembly enterprise.

For each workstation position were designed proposals to simulate each manufacture workstation conditions. Based on simulation results, were implemented the optimums proposal for the area.

Efficiency results doesn't show the results of the implemented change, because were launched new part numbers simultaneously to changes implementation. On the other hand, Productivity changed from 81.77% to 93.59%.

2 Problem Statement

Automotive wire harnesses Enterprise count with 2000 operative employees, a productive area of 236,000 ft², this study was performed in 18,000 ft², eight percent of total productive area, occupied by the secondary processes to produce high voltage automotive wire harnesses.

Secondary processes section shows deficiency on the quantity produced and workstations distribution. Initial efficiency was 52.3% as average, as presented on the Fig. 1, and management requirement is 80%.

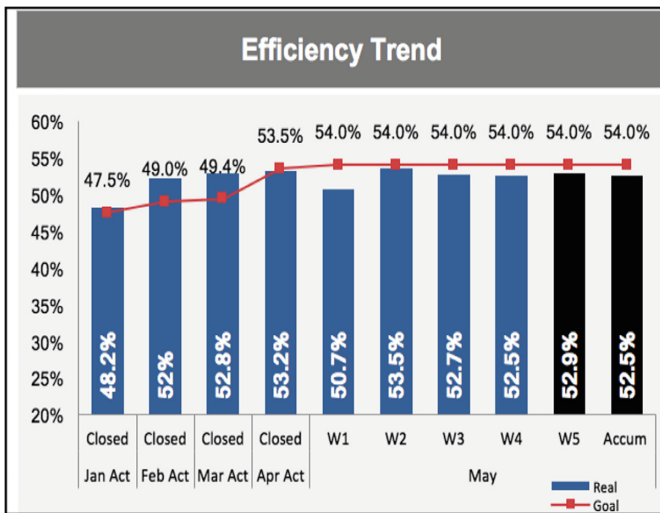


Fig. 1. Initial efficiency at secondary process section. This presents initial efficiency shows an average of 52.3% during the month of May (W1, W2, W3, and W4), far away from requirement 80%.

2.1 General Objective

Improve productivity 12% in secondary processes area at automotive wiring harnesses enterprise, through: (a) Reducing workstations' quantity through a reevaluation and workloads distribution, (b) Reducing space quantity actual, (c) Reducing quantity of people, (d) Increasing level of compliance of safety and ergonomic requirements.

2.2 Production Process

A production process is an activities' serial required transforming raw material or energy in some good or service, as Izar Landeta (2016), defines a serial of production processes that add value to a product. Secondary processes area, processes cables in different ways, like coaxial cables process and their subsequent processes: strip off cable, components assembly, splints and terminals press, direct cables with sonic bench press, and cables with insertion of tube for blend it.

Coaxial cable process start striping back insulation of the cable, removing part of insulation and grid, at each cable side using a dedicate equipment, one for each operation.

Components assembly are processes that insert one or several components, orderly, before been bench pressed, according to wire harness design.

Applied bench-presses manually because this application cannot be considered to be done automatically; mechanical terminals and splints are included in this process. Splints are part of wire harnesses that contain coaxial cables to function in the harness as current providers of the coaxial cable second cover.

Terminals and splices sonic press are processed by sonic bench presses. Sonic bench press process is the cable points/terminals jointed through vibration resultant of an ultrasonic emission by a sonic press.

Sleeves heater is the process to apply heat to a cover called sleeve, to protect specific areas of the wire harness. Time and temperature are the clue variables of this process.

In secondary processes high voltage section, certain wire harnesses require a metallic tube for protection; called tube-bending process. With this process, wire harnesses are able to get tridimensional shapes. It is used a robotic arm in this process.

2.3 Distribution Area

Distribution area is physical accommodation of workstations, including necessary spaces for material flow in the process, material storage, operative personnel position, and routes of other enterprise areas. During distribution area projection in productive area, planned in a way to reach an efficient distribution (Muther 1970).

Distribution area is looking forward more productive, secure, and satisfactory work areas for personnel interacting directly or indirectly with workstations; also is focused in reduce quantity of area used, like reduce non-necessaries aisles, material in process awaiting for too long, excessive separation distances among workstations, to mentioned a few.

Advantages of a good distribution: process material control improved, to facilitate workstation maintenance, visual presentation of workstations enhanced.

Base on area distribution is imperative an entire integration of personnel, raw material, material in process, machinery, and auxiliary activities.

2.4 Densification

Densification means compression in area distribution in workstations of productive area in a manufacturing enterprise. Compression area is looking forward effective usage of productive space available, through reduction of workstations dimensions or area redistribution. This study is looking also to improve in process material handling.

2.5 Connectivity Systems

Distribution area improvement requires connectivity systems, Kanban system selected in this study. Kanban card main function is to behave as a *work order* for each process, with this, the function is give movement to material in process, initiate construction of some product in any moment and to give instruction of processes based on area distribution. The main principles of Kanban system are waste elimination (handling, material/movements), continuous improvement (support to improve production activities), personal and organizational participation and usage, and visibility in material in process.

Using Kanban as a connectivity system gives advantage of overproduction elimination, what requires by Kanban is the only produced; production is prioritized base on signal shots. In this way, Kanban facilitates, process material control and processed material inside any distribution area planned to be produced.

2.6 Manufacturing Flow

To develop a manufacturing flow is necessary to be aware of each process of each wire harness to be produce, to group the processes and base on it, create workflows using centralized workstations, instead of individual workstations dedicated to process each family independent.

The manufacturing flows are representations of each one of material movements performed until the process is finished. Figure 2, shows Manufacturing flow at secondary processes area at wire harnesses enterprise. Shows process since raw material until subassembly is complete to be used into wire harness. Start on station 2, where components assembled and pass to subassembly rack; from subassembly rack some material goes to Press 1 to splint and bench press, after that operation pass to Press 2 to splint and bench press different components, from there pass to Press 6. M Press 6 is splint, bench pressed with components of subassembly rack, from there pass to Press 7, and last station is specific applications, from there, complete subassembly is stored into finished subassembly rack.

Subassembly area build between 70 to 80% of total content of this type of wire harnesses, the rest of work content, taping, electrical test are performed at finished assembly area.

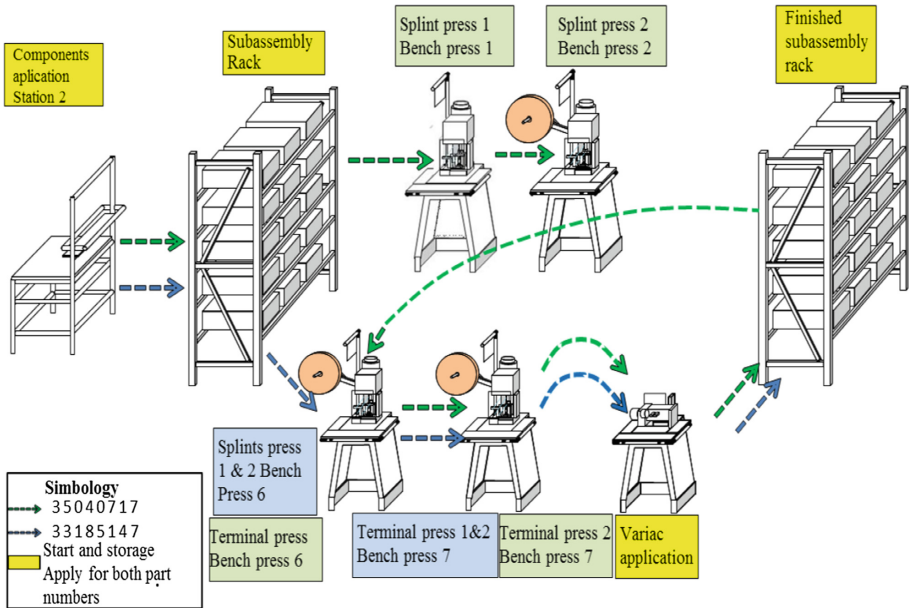


Fig. 2. Manufacturing flow. Secondary processes area at wire harnesses enterprise. This shows process start on station 2, where components assembled and pass to subassembly rack; from subassembly rack some material goes to Press 1 to splint and bench press, after that operation pass to Press 2 to splint and bench press different components, from there pass to Press 6. M Press 6 is splint, bench pressed with components of subassembly rack, from there pass to Press 7, and last station is specific applications, from there, complete subassembly is stored into finished subassembly rack.

3 Methodology

A production process is an activities’ serial required transforming raw material or energy in some good or service, as Izar Landeta (2016), mentions a serial of production processes that add value to a product. Secondary processes area, processes cables in different ways, like coaxial cables process and their subsequent processes: strip off cable, components assembly, splints and terminals press, direct cables with sonic bench press, and cables with insertion of tube for blend it.

Four steps followed to reach the objective:

3.1 Manufacturing Flows Improvement

To be able of improve efficiency and productivity is necessary to know actual capacity of each workstation. First stage was identifying common workstations by process containing each wire harness, to find out the best raw material flow. Original distribution area shows nonproductive material flows, to counteract this situation proposed centralize the processes, improving simultaneously the actual manufacturing flows. A value chain mapping is the best tool in this case (Muther 1970). Figure 2.

Manufacturing flow. Secondary processes area at wire harnesses enterprise, shows new manufacturing flow, present how material flow to process using centralized workstations of components assembly and bench presses for all families with common processes.

3.2 Workstations Rebalancing

To develop this step was necessary to know actual capacity for each workstation before change. Similar workstations identified, also workloads for each station, and production daily volume required. Workstations are installed in a central area, could be loaded with one product of each wire harnesses or several; rebalancing should consider one route to deliver each component to each line and workstation where is used. Equipment usage for centralized shape installation should be 95%. To determine utilization percentage for each workstation criterions considered were: out speed for each harness in seconds, line pieces per hour produced, volume of harnesses to be processed, similar components study, drawing product identification and cycle time for each process. Time studies for each process should be developed and documented because this processes are relatively new at the plant, at specific format, to analyze them during the workstation workload definition (Sivarsankaran and Shahabudeen 2014).

3.3 Workstations Area Distribution Design

The new distribution area selected from several proposals received from the different departments involved in this secondary processes section. These wire harnesses families have common processes each other, bringing about positive change in distribution, as equipment quantity reduction, better area utilization, operative personnel reduction. New distribution selected is distribution by process or by function, where all similar operations of the same process grouped. After get information a document to concentrate it was issue, points included into document: workstation name, number of cycles to perform, cycle time and handling, set-ups quantity, utilization total time and utilization percentage for each workstation. Selected type of area distribution' advantages: better use of available space, easy adaption to different wire harnesses types, not affects daily production variation (Muther 1970; Greig et al. 2018).

3.4 Result Analysis

Information taken in two different times, initial information taken from three months before intervention, the metrics are efficiency and productivity, final information taken from three months posterior to intervention. Graphs and registers analyzed. The two scenarios are compared, two variables during different periods.

Workstations show, initially, disorder, changes on workloads, lack of identification in materials containers and workstation itself, visual control, as presented on Fig. 3 Workstation before distribution changes, Fig. 4 Workstation after distribution changes. Workstations show, proper spaces to place material, containers identified and Fig. 5 Workstation presents improvements. This Figure shows numbers to identify names of

components added, for example number 5 show where the samples container is, operator will know where to put them, also inspector; number 7 show where micrometer holder should be.



Fig. 3. Workstation before distribution changes. Workstations show, initially, disorder, changes on workloads, lack of identification in materials containers and workstation itself, visual control.

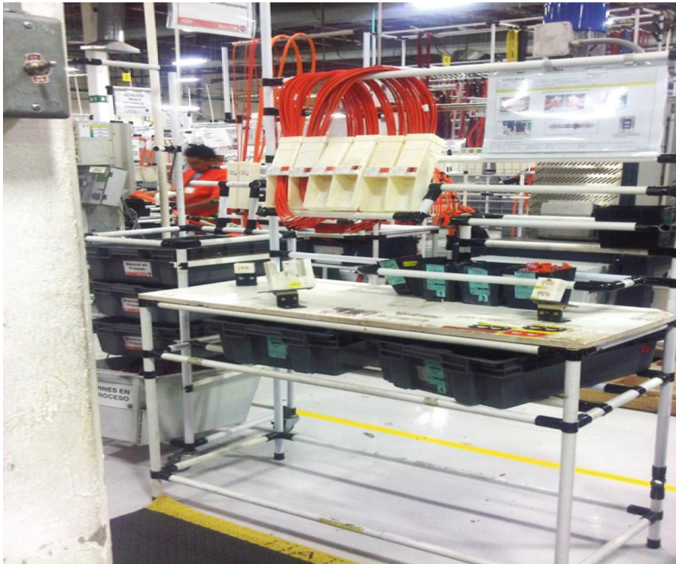
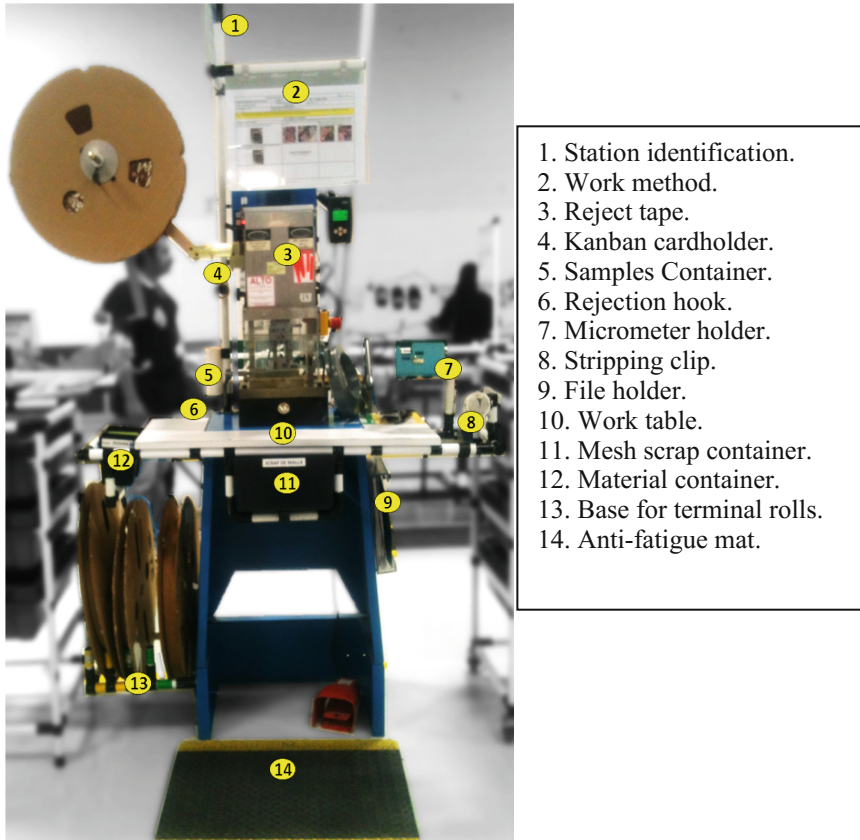


Fig. 4. Workstation after distribution changes. Workstations show, proper spaces to place material, containers identified.

After changes, workstations show proper spaces to place material, containers identified, cleanness, order as presented on Fig. 4 Workstation after distribution changes. Figure 5 Workstation presents improvements. The Fig. 5 shows numbers to identify names of components added, for example number 5 show where the samples container is, operator will know where to put them, also inspector; number 7 show where micrometer holder should be.



1. Station identification.
2. Work method.
3. Reject tape.
4. Kanban cardholder.
5. Samples Container.
6. Rejection hook.
7. Micrometer holder.
8. Stripping clip.
9. File holder.
10. Work table.
11. Mesh scrap container.
12. Material container.
13. Base for terminal rolls.
14. Anti-fatigue mat.

Fig. 5. Workstation presents improvements. This Figure shows numbers to identify names of components added, for example number 5 show where the samples container is, operator will know where to put them, also inspector; number 7 show where micrometer holder should be.

Workstations distribution design was developed base on new manufacturing flows and equipment workloads, Fig. 6, show graphically capacity workloads defined for each workstation and each person position into productive section. This section contains around 20 automotive wire harness families; each family had installed dedicated equipment. Families have common processes among them. This common processes favor area distribution change, reducing installed equipment, operative personnel, improving efficiency and productivity.

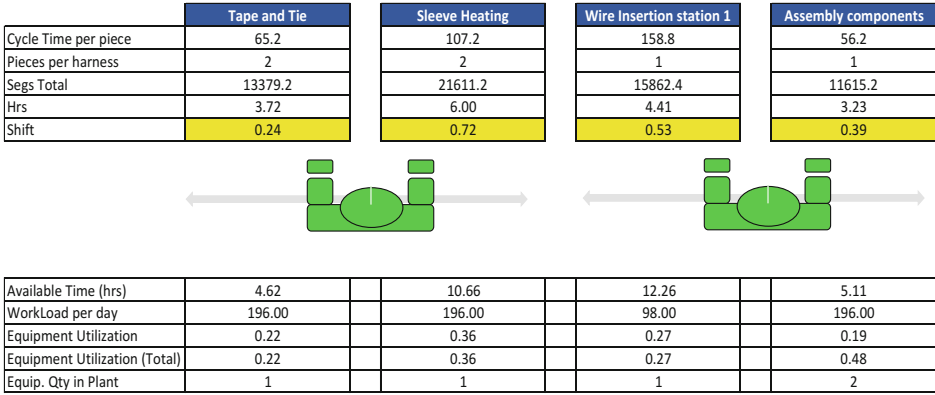


Fig. 6. Workstations distribution design, shows graphically capacity workloads defined for each workstation and each person position into productive section.

Secondary process area centralized into five areas: strip back insulation wire, bench presses cell, coaxial cables, cable insertion and tube bending and sonic bench presses. New distribution area performed thru a work team formed by representative of department’s involved, open mind and looking for continuous improvement, personnel and as a team.

4 Results

Final efficiency at secondary process section presented on Fig. 7. show final efficiency average efficiency for Jun 49, July 46.4, Aug 38.05%. These results are due to new programs launching, learning curves for operators and administrative personnel, scrap originated in early steps, quantity of personnel involved during implementation (Fig. 8).

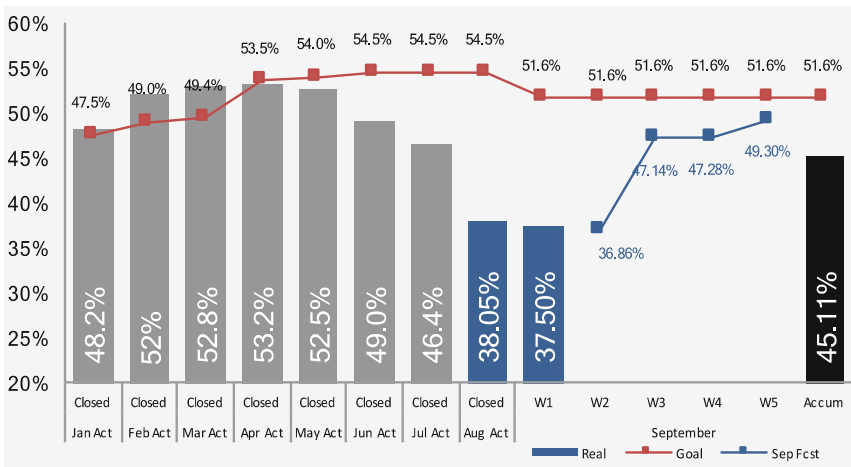


Fig. 7. Final efficiency at secondary process section. This presents final efficiency show average efficiency Jun 49, July 46.4, Aug 38.05%. These results are due to new programs launching, learning curves for operators and administrative personnel, scrap originated in early steps, quantity of personnel involved during implementation.

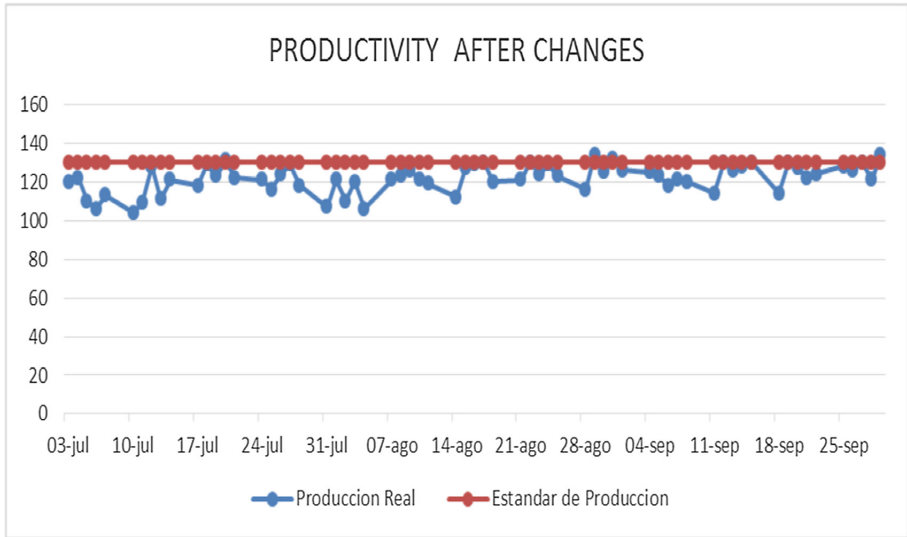


Fig. 8. Productivity after implementation changes. This presents final efficiency show 93.59%, and increase of 11.8%.

Even though efficiency reduced several index points due to external causes as new programs launching, and proper implementation of new program, by other side, productivity improved from 81.77 to 93.59%, an increase of 11.8%.

5 Conclusions

Invest capital and time to perform a distribution area change into secondary processes section of high voltage area, it worth it, because improved connectivity among all workstations (manufacturing flows), reduced workstations installed quantity and people working to meet requirements, and incremented productivity and efficiency but overall ensure high satisfaction among employees.

References

- Greig, M.A., Village, J., Salustri, F.A., Zolfaghari, S., Neumann, W.P.: A tool to predict physical workload and task times from workstation layout design data. *Int. J. Prod. Res.* **56**(16), 5306–5323 (2018). <https://doi.org/10.1080/00207543.2017.1378827>
- Izar Landeta, J.M.: *Manufactura de Clase Mundial*. Alfaomega (2016)
- Muther, R.: *Distribucion en Planta*, eds. Segunda, Europea, E.H., Trad. Rabadá, C.M. McGraw Hill Book Company, Barcelona, España (1970)
- Sivarsankaran, P., Shahabudeen, P.: Literature review of assembly line balancing problems. *Int. J. Adv. Manuf. Technol.* **73**, 1665 (2014). <https://doi.org/10.1007/s00170-014-5944-y>



Technology Start-Up Firms' Management of Data Security and Trust in Collaborative Work with Third-Parties in a Developing Economy

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Abstract. This study seeks to provide an understanding of how data security and trust is managed in the collaborative work between technology start-up firms in developing economies and third-party entities. Using qualitative data from Ghana which was analyzed thematically, it was found that the measures taken to ensure the security and privacy of client datasets vary in intensity among firms. Thus, in collaborating with third-parties, the firms largely depend on industry best practices, policies and service-level agreements, and thus do not attempt to integrate the policies of collaborators with their firm's policies except in situations where the inclusion elimination of certain clauses are collaborative pre-requisites. The firms also have trust criteria which they use to pre-qualify third-party entities with whom they collaborate. It is concluded that technology start-ups possess attribute that show their core competencies and the quality of their deliveries, but might require a regulatory body to monitor their operations.

Keywords: Technology start-up firm · Third-party entity · Data security · Trust management · Collaborative work · Developing economy · Ghana

1 Introduction

Globalization requires that organizations seek out ways through which they can transcend national boundaries to adequately and profitably meet customer demands [1]. This development has necessitated a new paradigm of work where organizations have been restructured to include such forms of work as outsourcing, offshoring, telecommuting and virtual team-working among others [1]. Individuals therefore no longer have to be together in the same vicinity to get work done as emerging digital technologies have made it possible for people to collaborate without necessarily being together and for managers to lead and manage the workplace from a distance [2]. For technology start-up firms, this practice has resulted in their leveraging on cloud-computing to do business [2]. These firms accomplish this by developing software and other technology-driven applications and services using the servers of bigger technology firms who have the capacity to keep them running, and by implication serving service-platforms for the start-ups [2]. By so doing, technology start-ups form collaborations with bigger software development and technology firms to ensure that they

can develop and host their software solutions without having to invest so much financially [2].

The Information Communication Technology (ICT) Industry in Ghana is characterized by an extensive infrastructure network and an emerging start-up ecosystem [3]. The industry has grown to be considered a critical component of economic growth in the last decade, recording double-digit growth rates and generally outperforming the economy in its entirety [3]. The industry consists of telecommunication operators, internet service providers, application developers, VSAT data operators, software manufacturers, broadcast institutions, ICT education providers and internet cafes among others [3]. The Ghana Association of Software and IT Services Companies (GASSCOM) is another body regulating the activities of players within the ICT industry in Ghana [4]. GASSCOM was established in the year 2007 as Ghana's premier trade association for the IT software and services industry. Members of GASSCOM are companies who are into the business of software development, software services, IT-enabled BPO services and E-Commerce [4]. While Ghana may not be counted among the three largest start-up investment destinations in Africa, it is an obviously attractive location for technology start-ups to thrive [4]. For instance, while Nigeria may have more liquidity than Ghana because of her market size, Ghana has better market stability [4]. The stability of the Ghanaian market makes it a better place to launch most IT products, hence the rise of this industry [4].

For technology start-ups in Ghana, the cloud serves as an essential platform for collaboration. Due to the complexity of the cloud and the resource constraints that most cloud providers face, service-provider collaborations are leveraged on by the start-ups to enable their profit maximization and the delivery of quality services to clients. For instance, if a software company in Ghana designs an application using the cloud infrastructure provisioned by Google and then decides to test the performance of its application on LoadStorm, the company would have to go beyond deciding whether to trust Google and LoadStorm to ascertaining if Google and LoadStorm they trust each other.

The purpose of this research, therefore, is to provide an understanding of how technology start-ups in Ghana function without operational challenges, especially regarding how the issue of trust is handled in their collaborative operation with third parties. This is because most technology start-ups rely on third parties to get work done in order to deliver value to customers. Looking at the way these firms operate, it is essential to understand how these firms are able to do business with third parties and virtual clients without operational challenges or by implication how trust is handled in their collaborative operation with third parties.

2 Literature Review

Cloud computing is a computing service model with its fair share of fears, uncertainties and concerns surrounding its adoption, implementation and maturity [5]. Cloud consumers make a plethora of decisions based on trust [6], making trust an integral part of cloud computing, necessary for its adoption and growth [7]. Therefore, establishing trust between the providers and consumers of cloud services is critical to the acceptance

and operation of cloud computing [6]. It is important for individuals to have their basic trust needs met if they must progress to more substantial interactions with cloud providers in the cloud [7]. Establishing trust is however gradual and thus require time to mature [7]. The transactional relationship existing between the cloud provider and cloud consumer starts from a state of no trust established trust and evolves through several stages of commitment with each stage building on the trust established in the previous stage [8].

Major concerns to cloud computing practice emanate from issues such as reliability, security, privacy, control as well as vendor lock-in and performance that come to play because of the virtualized setting of the cloud [9]. With enterprise computing, data is stored and under the full control of the organization. Third parties however come to play the storage and management of data in the cloud [10]. This increases the risk of security breach in cloud computing necessitating the deployment of additional security measures to ensure data security [10]. Building and maintaining trust in the cloud requires the integrity and privacy of data, both being possible through encryption and the availability of data [6]. Trust by nature cannot move from one entity to another, it cannot be shared or added together, and neither can it be symmetrical. Trust is subjective, uncertain and context-dependent [11]. It comprises of such features as honesty, dependability, truthfulness, reliability, security, competence and timeliness that is, considered within the context from which one offers trust [6].

Maintaining data confidentiality, integrity and availability is however more complicated in cloud computing compared to enterprise computing. This is largely due to distributed nature of the cloud-computing infrastructure [10]. The cloud provider must ensure the creation, classification and identification of sensitive data, and also put in place policies as well as access methods for data [10]. The provider should also store the consumer's data securely and include a backup and recovery plan or policy in the case of data loss [10]. These policies are, jointly referred to as a Service Level Agreement (SLA). Data integrity encompasses the accuracy, the security of data as well as the privacy of data in cloud computing environments [6]. Integrity relates to the provider delivering on their word while security speaks to data safety, where data loss is likely to occur due to poor network latency [6]. Accuracy on the other hand relates more to data precision, the loss of which may be because of obsolete computing infrastructure [6].

The cloud is service-oriented, due to this embedded nature of the cloud; there is a need to integrate trust with the provisioned service [12]. The underlying logic is that the higher the amount of service provisioned by a cloud provider, the higher the level of trust they must establish [12]. For successful cloud transactions, users would have to have some level of trust in the provider and the provider, in the consumer [12]. Thus, the cloud provider would have to develop a trust management approach that is bi-directional and integrated with the provisioned service [12]. Trust management techniques may take the form of policies, recommendation, reputation and prediction and may be, explained from either the perspective of the service-requester or that of the service provider [13]. Providers of cloud services have policies in place that regulate access to their services as well as control the disclosure of credentials [13]. The trust threshold of the cloud service provider can make use of the credentials or credibility approaches [13]. The approach adopted would however be dependent on the evaluation of the consumer

[13]. If the threshold requirements relating to reliability and credibility are fulfilled, the provider-consumer relationship is considered a trustworthy and reliable one, and if they are not satisfied, the relation is considered as not being trustworthy [13].

Individuals and businesses make use of recommendation to manage trust in the cloud as well as in service-focused environments [7, 13]. This technique for managing trust leverages on a one's knowledge of the trusted parties and comes into play in situations where the individual or business in question has an idea of the origin or source of the feedback given [7, 13]. This technique is rooted in a social psychology theory that posits that the character or relational tie of a given individual has a significant impact on the trust evaluation of another individual when a recommendation is given [7, 13].

Another technique employed in managing trust relations is reputation, which deals largely with feedbacks and is essential for the management of trust in the cloud [7, 13]. The feedback of one cloud consumer has the capacity to radically improve the lot of the provider by positively influencing how others perceive it or mar the reputation of such a provider [7, 13]. With Reputation as a trust management technique however, there are no trusted relations as consumers and other users may have no idea about the source of a trust feedback [7, 13].

Prediction is the fourth technique used to manage trust and is beneficial in situations where there is no previous knowledge or prior information about a given service offering in the cloud [7, 13]. Consumers therefore depend on the opinion of other users to decide to trust or not to trust a given cloud service or provider [7, 13]. The underlying logic is that like-minded entities or individuals are more likely to trust each other and jointly determine whether trying out a new service or using an unpopular provider is a good decision [7, 13]. Prediction as a trust management technique was proposed for use in cloud environments and service-oriented environments [7, 13].

3 Methodology

3.1 Study Sample

The study sample consisted of four technology start-up firms in Ghana operating on cloud computing technologies to develop software applications and other computer-driven utilities for clients. The snowballing technique was used to select the four firms, each of which is profiled in the sections below.

Firm-1. This firm is a technology start-up that focuses on smallholder farmers and organizations that require access to agricultural related resources to function effectively. With the firm's software, farmers are able to connect with markets, insights of farming techniques, financial information and weather forecasts through their mobile phones. The company transmits vital information to farmers through text message as well as voice messages that are delivered in the preferred language of individual farmers. It operates the 399-Information Service that delivers real-time insight in agriculture to smallholder farmers via their mobile phones.

Firm-2. This is a technology solution firm that provides customized technology solutions that include; systems analysis and design, business process modelling,

creation of responsive websites and applications, bulk and voice-sms and digital marketing. The firm leverages on the cloud platform and deals virtually with operators of the platforms to enable deliver its service to its clients.

Firm-3. It provides financial services to clients via mobile technologies. The company makes payment transactions over the phone easier by operating as an aggregator in order to combine the transactions of different players on a single platform. The firm's software runs on an open source technology and it is designed to integrate different payment platforms, mobile network operators, banks and merchants among several others. The platform accepts debit and loyalty cards, mobile money wallets and cash at the point of sale.

Firm-4. This is a software company that offers software and technology platform that allows churches to effectively manage, engage and connect with their members, and also for church members to get content from services, information about events as well as donate or pay tithes and offerings at their convenience. The firm's software consists of a database of church members, tools for monitoring church meeting attendance, features for financial management as well as tools for event creation and sharing, branch integration and reporting systems, and functionalities for managing church groups. The app makes it easy for members to receive such things as sermons, devotionals, event notices and other forms of information with only a click. It also enables church members conveniently send their prayer requests and redeem financial commitments anytime and from anywhere.

3.2 Data Collection and Analysis

Qualitative data was collected through semi-structured interviews with selected managers in the four technology start-ups. The interview guide was developed through best practices from extant literature. The interview guide contained nine questions bordering on how technology start-ups operate and how they handle trust in the cloud. All nine questions were asked during each of the interviews which lasted between thirty and forty-five minutes. All the interviews were recorded, transcribed and analyzed.

4 Results and Discussion

4.1 Managing Data Security in Startup Firm-Third Party Collaboration

Firm-1. Analysis of interview data showed that this firm ensures that client datasets are stored in the cloud, which gives a level of assurance, since it is readily available as and when clients need it. The company's platform is client-based and highly encrypted and so the company does not have access to datasets that clients upload to the cloud. The firm's application is built in such a way that all data are owned by the client. The firm has specific contracts in place to ensure that there are no breaches from their side, and also provides alternatives for clients who are unwilling to store their data on the firm's platform, as it is highlighted in the following comments by an interviewee in the firm;

Our firm provides clients with APIs through which their data is transferred directly to their preferred servers and deleted from the firm's servers immediately.

Firm-2. Analysis of interview data showed that this firm, is guided regulatory frameworks in handling data confidentiality, integrity and availability. The firm's operation is guided by the General Data Protection Regulations of Europe and the Data Protection Act in Ghana, as it is highlighted in the following comments by an interviewee in the firm;

Because our firm is in Ghana, there is a need to be guided by the regulatory frameworks of Ghana so that the company does not have issues with authorities. The company has gone through the two regulations and ensures that in handling data these two regulations are followed to the latter.

Firm-3. Analysis of interview data showed that this firm uses authentications, APIs and firewalls, to enhance data security, with transactions encrypted and decrypted. Employees of the firm also have a confidentiality clause in their contracts which ensures that clients' information is protected. The firm does not allow unauthorized devices to have access to client datasets. The firm is a signatory to the Data Protection Act, and ensures that all provisions of the Act, including the conduct of annual IT audit. The firm enables transactions within VPN environments, meaning that such transactions are privately protected from origination to termination, by ensuring that the firm's cloud provider has a backup cloud, as it is highlighted in the following comments by an interviewee in the firm;

It is not enough for our provider to have one central place in America where the data is stored. They should have another server in say Holland or Africa somewhere as a backup.

Firm-4. Analysis of interview data showed that this firm is registered with the Data Protection Agency in Ghana and ensures that all security protocols prescribed by the Data Protection Act are adhered to. Since the firm works with other parties in the cloud, it collaborates only with parties that are trusted brands and ensures that standard contracts and agreements are signed to enhance the protection and confidentiality of clients' data. The firm also uses Service Level Agreements which identify clients' as owners of their data, as it is highlighted in the following comments by an interviewee in the firm;

Our firm basically helps clients keep their data and structure it in a meaningful way. These contracts are signed by our clients for them to know that our firm cannot use their data for anything other than what they the clients intend to use it for.

Based on the analyses of the four firms, it can be inferred that a major issue arising in the cloud is the privacy of data and its security and technology start-ups in Ghana ensure that they are guided by the provisions of the Ghana Data Protection Act in the provisioning of their service offerings. In addition to the Ghana Data Protection Act, because of the universal nature of the business technology start-up firms are engaged in, the firms also subject their operations to the tenets of the General Data Protection Regulation, which was recently passed into law in Europe. The firms also ensure the security of clients' datasets through data storage in encrypted formats. Encryption helps

protect clients' data that is transferred or stored in the cloud from being compromised and is used to ensure the confidentiality of data. Though encryption helps to protect data from unauthorized access, it does not prevent data loss making it limited in its ability to secure clients' data. To this end, the firms use other data security frameworks and protocols to ensure the prevention of unauthorized access as well as the loss of data. Additionally, the firms use APIs and additional security plugins to highly secure data and prevent hackers from gaining access to applications and sites provisioned to clients. The firms also operate within Virtual Private Networks (VPNS) to create a safe and encrypted connection in less secure cloud environments. Finally, some of the firms use social engineering in the management of clients' datasets by ensuring that firm-employees sign confidentiality agreements, as well as undertakings not to log on to their firms' servers with unauthorized devices.

4.2 Managing Trust in Startup Firm-Third Party Collaboration

Firm-1. Analysis of interview data showed that this firm looks out for industry best practices and also gets recommendations from other industrial players on that enhances trust in their operations, as it is highlighted in the following comments by an interviewee in the firm;

At a point, we were planning on whether to use Amazon Web Services or Microsoft Azure, which are the major players in the industry, based on their reputation. In the end, we chose to go with Amazon Web Services based on recommendations. So, we use reputation in synchronization with recommendations.

Firm-2. Analysis of interview data showed that this firm as viewing trust as something that is first given before it is earned. As such, the firm views policy as an enabler of trust. The firm does not depend on recommendation as a guarantee to trust a cloud provider. Rather the company establishes trust by creating sustainable relationships with clients and providers after which policies come in as an add-on, as it is highlighted in the following comments by an interviewee in the firm;

We believe that if you have a framework that we need to use, it means you believe in your framework and we do in ours and if we are to collaborate, there should be a level of trust. However, policies are used as guidelines to guide the relationship. Policies come in when trust has been established. What is the use of policy when there is no trust?

And,

We develop systems for our clients with the faith that they will pay, not because they have made any financial commitments, but because we chose to trust that they will. Policies then later come into play. We see policy as an add-on to our trust.

Firm-3. Analysis of interview data showed that this firm rely on policies, which include service level agreements and privacy policies as base for managing trust with collaborators. The firm also makes use of recommendation and reputation to manage trust in their relationships with third parties in the cloud, as it is highlighted in the following comments by an interviewee in the firm;

The firm to collaborate in the cloud environment, we seek approval from the bank of Ghana. We are also guided by the OFAC and the US Treasury regulations in securing our platforms as way of inculcating trust in our clients.

Firm-4. Analysis of interview data showed that this firm use policy as a trust management technique. The firm has standard service level agreements that inform clients that they retain ownership of their data with the firm only acting as a caretaker, safeguarding and managing the data and making it readily available in meaningful ways clients on demand. The firm also has privacy policies that state that employees are only privy to client data they need per time to get their jobs done and that even before the data of a client is touched or tampered with, the firm's permission, per the firm's policy, must be firstly requested. The firm also uses reputation as a trust management technique in deciding who to partner with, as it is highlighted in the following comments by an interviewee in the firm;

The tokens on our systems are cached and encrypted, so one cannot just have access to clients' information by logging onto a browser. This is because, we look at our collaborators policies and make sure that it meets our requirements, especially regarding data protection and service delivery before we do business with them. Also, we look at reputation. Knowing that our collaborators provide services to bigger firms like Instagram and Dropbox among others, we trust them to be able to deliver superior services to our firm.

Based on the analyses of the four firms' management of trust with collaborators, it can be inferred that a major issue arising in the cloud is the privacy of data and its security. Service level agreements and privacy policies are two major policies deployed by technology start-ups in Ghana to manage trust when collaborating in the cloud. These documents or policies take their bearing from the regulatory framework provided by the General Data Protection Regulation and the Ghana Data Protection Act to which most of the technology start-up firms are signatories. Additionally, some firms tend to maintain high standards of service delivery and reliability as way of inspiring trust in their collaborative environments. On the other hand, most technology start-ups also check the track record of cloud providers to ascertain their ability to deliver excellent service before any partnership or collaboration is made. Moreover, because most of the practices in the information technology industry are standardized, technology start-ups make use of industry best practices to decide on what companies their cloud providers are and with what companies they collaborate with in the cloud. These technology start-ups get to know these best practices through recommendations gotten from other players in the industry. In addition to these trust management techniques, some technology start-ups are governed by external regulatory bodies. Most of the decisions technology start-ups operating within highly regulated industries take including what parties to collaborate with in the cloud are vetted and approved by these external bodies or regulators. Thus, after looking at the policy and track record of the provider and getting a second opinion or recommendation from other players in the industry, these technology start-ups would be required to go a step further to present their options and preferred decision on whom to collaborate with in the cloud to these regulators for approval.

5 Conclusion

This study has shown that Technology start-up firms in Ghana are guided by the Ghana Data Protection Act and the General Data Protection Regulation of Europe and that these frameworks guide how technology start-ups handle data confidentiality, integrity and availability in the cloud. The firms leverage on security protocols such as data encryption, authentication and validation, cloud environment stress-testing and access controls among others to ensure the privacy and security of data. The measures taken to ensure the security and privacy of client datasets vary in intensity among different technology start-ups. The intensity of these measures is usually dependent on the Chief Executive Officer's philosophy regarding the security and privacy of client datasets as well as the industry within which the technology start-up operates. It is therefore concluded that Ghanaian technology start-up firms largely depend on industry best practices and do not attempt to integrate the policies of collaborators with their firm's policies except in cases where they try to negotiate to have certain clauses included or eliminated. The firms also use at least one of four trust management techniques with majority of them using policy, reputation and recommendation and a few using prediction, in managing trust in their collaborative operations with third parties.

The implication is that regulatory bodies must be put in place to monitor the level of compliance of technology start-up firms with policies and regulations. It is not enough to have policies and regulations in place to guide the operations of cloud providers. Mechanisms must be put in place to ensure strict compliance. Trust in the cloud is a two-way traffic. It is possible that the cloud provider secures data and protects it from unauthorized access but then, the same data can be accessed from the client's end through social engineering. It is therefore important that firms operating on the cloud beef up their authorization and validation systems and put measures in place to reduce social engineering incidences. It is essential that trust is maintained and sustained through a thriving relationship with partners and collaborators, regardless of the orientation of the collaboration platform.

References

1. Dhillon, G., Syed, R., Sa-Soares, F.: Information security concerns in IT outsourcing: identifying (in)congruence between clients and vendors. *Inf. Manag.* **54**(4), 452–464 (2017)
2. Gibson, C., Gibbs, J.: Unpacking the concept of virtuality - the effects of geographic dispersion, electronic dependence, dynamic structure and national diversity on team innovation. *Admin. Sci. Quart.* **51**(3), 451–495 (2006)
3. Ntibrey, L.L.K.: ICT strategies of Ghana - the role of policies and regulations. Mini Project, mICT, Markets and Regulation, Aalborg University, Denmark, February 2012. http://www.academia.edu/10372484/ICT_STRATEGIES_OF_GHANA_The_role_of_policies_and_regulations. Accessed 10 September 2018
4. Greenberg, M.: The 2014 Ghanaian startup ecosystem. http://meltwater.org/wp-content/uploads/2014/09/Ghanaian_Startup_Ecosystem_Report.pdf. Accessed 12 September 2018
5. Sultan, N.A.: Reaching for the cloud: how SMEs can manage. *Int. J. Inf. Manag.* **31**(3), 272–278 (2011)

6. Chiregi, M., Navimipour, J.N.: Trusted services identification in the cloud environment using the topological metrics. *Karbala Int. J. Mod. Sci.* **2**(3), 203–210 (2016)
7. Manuel, P.: A trust model on cloud computing based on quality of service. *Ann. Oper. Res.* **233**(1), 281–292 (2015)
8. Sherwin, K.: The hierarchy of trust: the 5 experiential levels of commitment, 2016. <https://www.nngroup.com/articles/commitment-levels/>. Accessed 15 September 2018
9. Chou, D.C.: Cloud computing: a value creation model. *Comput. Stand. Inter.* **38**, 72–77 (2015)
10. Kumar, P.R., Raj, H.P., Jelciana, P.: Exploring security issues and solutions in cloud computing services – a survey. *Cybern. Info. Tech.* **17**(4), 3–31 (2017)
11. Sun, D., Chang, G., Sun, L., Wang, X.: Surveying and analyzing security, privacy and trust issues in cloud computing environments. *Procedia Eng.* **15**, 2852–2856 (2011)
12. Takabi, H., Joshi, J.B.D, Ahn, G.-J.: SecureCloud: towards a comprehensive security framework for cloud computing environments. In: 34th Annual IEEE Computer Software and Applications Conference Workshops, pp. 393–398. IEEE Computer Society (2010)
13. Noor, T.H., Sheng, Q.Z., Zeadally, S., Jian, Y.: Trust management of services in cloud environments: obstacles and solutions. *ACM Comput. Surv.* **46**(1), Article 12, October 2013. <http://dx.doi.org/10.1145/2522968.2522980>

Leadership Style and Social Aspects



Leadership as a Key Component of Competence Model of Medium-Level Managers in Higher Education Institution

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Abstract. A new legal environment emergent from the Law on Higher Education [1] creates a demand for a new model of management in higher education institutions, one which should be based on the paradigm of transformational leadership. The aim of this paper is to present the results of a study which was conducted on a sample of 16 Vice-Deans in state-owned technical universities who represent a medium level of management. The research has shown the problem of “a triad of competence deficits” ranging from the ability to build relationships with the business environment to strategic management and leadership. Evaluation of management practices with MLQ Self appears to suggest that the analyzed group’s profile is that of a transactional leader, which may constitute a limitation for the processes of introducing profound changes in universities in the context of the new legal regulations.

Keywords: Management in higher education institutions · Competence · Models · Transformational leadership

1 Introduction

Higher education institutions in Poland have faced radical changes resulting from the new legal regulations stipulated in the Law on Higher Education and Science [1]. These are consistent with the requirements of the modern economy based on knowledge, innovation and international competition and should now define a framework for the functioning of higher education institutions. Meeting these requirements is connected, among others, with the need to implement professional management methods and tools. Formalization and bureaucratization combined with the demand to commercialize research results and compete on the international market of educational services forms a mixture of features limiting the applicability of corporate benchmarking solutions, which are based on decentralization of power, flattening of organizational structures, flexibility and adaptability. The university management practice should combine, on the one hand, an academic approach (retaining the principle of autonomy and academic tradition) and, on the other hand, a managerial approach. This requires a specific competency profile of the management staff, which is a prerequisite for introducing a managerial orientation based on business rules. The necessity of

introducing changes in universities is connected primarily with the demand that the management process be based on leadership competences [2] and as such it becomes particularly relevant today as research, analysis and implementation of new actions in the policy of human resources at universities is inevitable. The purpose of this paper is to present the results of a study which was conducted in 2018 on a sample of 16 Vice-Deans of 16 faculties of Polish state-owned technical universities who represent a medium level of university management. The idea of the research has been based on the hypothesis that the key barrier in introducing changes in higher education institutions is the apparent deficit in leadership competences of the management staff. Transactional leadership is the dominant model of leadership in higher education institutions at the secondary level of management. The implementation of the changes currently facing universities in Poland requires the management process to be based on transformational leadership that is conducive to increased self-motivation in employees. Competence deficits may result, among others, from obsolescence of the personal development programs in higher education institutions. This manifests itself in the fact that selection for managerial positions in universities is not preceded by competence balances, and career paths are not included in the university staff development programs but are rare in the practice of human resources management in universities.

2 University Management Models

Management models allow to optimize the implementation of processes in order to improve their quality and effectiveness in the area of administration of educational services and scientific research. These models differ fundamentally both in the area of dominant values and cultural norms as well as in the applied management styles and determine the mode of decision making, role of management, and dynamics of operations. McNay [3] presents organizational models of universities, which describe the style of management in such an organization. These models are mapped onto a grid created by two parameters: policy making and process control. They include four models: “College”, “Bureaucracy”, “Corporation” and “Enterprise” [3]. The college model is characterized by its orientation towards the individual. Decisions are collective and are reached through consensus. The decision-making process is prolonged in time, as in most universities there prevails a long-term time horizon. Bureaucracy model is governed by the formal management style. Rules, norms, procedures, and quality control dominate. The approach to changes could be described as reactive adaptation. In the Corporation model, authority orientation dominates. Tactical management style with medium distance orientation is adopted. A university organized in the form of a corporation has a focus on its staff rather than students. The basic value of the corporation is loyalty to the management. The approach to change could be described as “proactive transformation”. Institutions of higher education can also be organized on the model of an enterprise, whose operation is based on commercial market requirements. The “Enterprise” model is dominated by orientation towards tasks. Activities aimed at satisfying specific market demands are undertaken in task forces, whose members are selected on the basis of competence criteria. The management style relies on delegation of competences. The attitude to change is described

as “tactical flexibility”. Economization forcing the necessity of transforming universities into market enterprises is connected with the need for profound changes in the area of management. Trow [4] argues that the adoption of a market approach entails a departure from the “soft management” implemented by “managers/scientists”, who in their decisions are guided primarily by academic tradition. The environment demands that universities, which should today be more “entrepreneurial”, be managed in a hard way by groups of contract managers and professional managers. Implementing the concept of an entrepreneurial university into practice forces a change of orientation towards the market, innovation and management [5]. In the educational services and scientific research sector (frequently driven by commercial considerations and commissioned jobs), a competitive struggle continues. This process requires commitment from the management as well as from all employees and demands introduction of Employee Branding programs.

3 Competence Model for Medium-Level Managerial Personnel in Higher Education Institutions

As Du Toit [6] points out, university management work is a mixture of collegiality and managerialism on the one hand, and strong administrative structures on the other. The radical changes enforced by the introduction of Law 2.0 result in a demand for a new model of management in higher education based on the leadership paradigm. Nanjundeswaraswamy and Swamy [7] emphasize: “Today’s organizations need effective leaders who understand the complexities of the rapidly changing global environment”. Research shows that new leadership is essential in order to strengthen ties with the reality of diverse sectors of economy [8, 9]. It is based on authenticity, reflection, understanding of culture and values system [10] and, as Norris observes [11], is a key component of the competence model of higher education executives. Competences are a potential that leads to human behavior which aligns with the requirements of a given position within certain parameters of the organization’s environment, and which leads to achieving specific results [12]. Competences represent a mixture of knowledge, skills, personality traits, attitudes, and behaviors of employees aimed at achieving goals and performing tasks in ever-changing boundary conditions. Higher education institutions should develop a competence model for particular positions within the organization, which would constitute a specific framework defining the required skills and knowledge necessary for the proper execution of work in a given position. They would create a culture of high efficiency enabling the achievement of high financial results of the organization in the long term via a clear mission, cohesion, adaptability and involvement of employees [13]. The area of managerial competences within the competence model for higher education institutions should place special emphasis on the level of management. A distinction should be made between the managerial competencies of the members of the Rector’s Council (Vice-Rectors, Deans, Chancellor or Quaestor) and the managerial competencies of the management staff (Heads of organizational units such as faculty, institute or department). For the first category such key competences as strategic management of the university and faculties, decision making and delegation of powers and responsibilities have been identified. For Heads

of organizational units, key competences include the ability to manage a team, make decisions and motivate and develop subordinates. Taking into account the increasing complexity of the environment, which all organizational units of modern universities have to cope with, and the resulting need for continuous change, it seems that regardless of the level of management, key and superior leadership competences should be given special recognition. In the context of challenges faced by modern universities, new expectations and requirements emerge and they should translate into a competence model dedicated to universities. Competence models in the management of university staff are used sporadically. The key issue from the point of view of building the competence model is the analysis of roles and activities assigned to particular management levels. It should be borne in mind that there is a multitude of roles and this may potentially lead to a conflict of roles (Table 1).

Table 1. Role of medium-level management personnel in higher education institutions.

Administrator	Entrepreneur	Leader	Representative
Administration of the faculty, its staff and students	Acquisition of extra-budgetary funds for research. Marketing and promotional activities Commercialization of research	Defining directions of development and acquiring employees to implement changes	External representation of the organizational unit
Academic staff	Researcher	Liaison officer	Mentor
Implementation of the education process	Furthering own scientific research	Networking between science and business	Responsibility for the development of dependent employees

In the area of the medium-level management, the following activities are carried out:

- supervision over scientific and educational activity,
- external representation of the organizational unit,
- managing the administrative work of the Faculty.

Additionally, persons functioning at the medium level of management in a higher education institution perform the role of an academic teacher and a researcher. The performance of the above requires the management staff of modern universities to display a wide range of competences.

4 University Leadership Style in the Context of Change

In the context of radical changes which have begun in higher education institutions in Poland, the key becomes management based on transformational leadership, which develops the so-called spontaneous motivation, triggered by the very fact of carrying out the action, while the possible bonuses are relegated to the background. In the Bass model [14] transformational leadership requires four components: charisma (“idealized influence”), “inspiring motivation”, “intellectual stimulation” and “individual treatment” (individual approach to the employee). At the opposite end of the spectrum there is transactional leadership, the essence of which lies in building the targeted motivation of employees, who are focused on the task completion. It is founded on three pillars: occasional bonus and management through objection - active or passive. The occasional bonus is based on an agreement between a manager who communicates his or her own expectations to his or her subordinates and presents the potential bonuses they can receive in return. Active management through objection involves monitoring the behavior of employees, anticipating potential problems and taking specific preventive actions. Passive management through objection involves a reaction of the superior to a given problem only after it has occurred [15–17]. Empirical studies show that transformational leadership is strongly correlated with such results and behaviors in a work place as lower turnover, higher productivity, employee satisfaction, creativity, achievement of goals and contentedness with oneself. Transactional leadership is sometimes assumed to be a part of transformational leadership [18].

5 Research Methodology

Pilot studies were conducted on a sample of 16 Vice-Deans of 16 faculties of state-owned technical universities. The respondents represent the medium level of university management. The selection for the sample was purposeful, taking into account the criterion of availability of respondents. The research was carried out using the SSI (“Semi Structured Interview”) technique. SSI consists in conducting qualitative research by asking both closed and open questions, which make it possible to obtain extended information and to deepen the knowledge about the problem under study. The questions referred to the author’s leadership traits model, which was verified in the research based on the inventory of managerial competences at a university (IKP) and was presented in the form of a list of competences. Respondents were asked to assess the importance of each item in view of the work they do using the 5-point Likert scale. The scale used the method of summation of assessments. The task of the surveyed Vice-Deans was to assess each of the 15 competences according to a five-point scale expressing different degrees of acceptance and evaluation of a given statement. In addition, the Multifactor Leadership Questionnaire Self (MLQ Self) by Bass was used to identify the perception of respondent’s own leadership style [14].

6 Leadership Competence Profile in the Light of the Study Results

The survey asked respondents to self-assess selected leadership competences building a model for medium-level management in higher education institutions in the following categories: “1 - not important”, “5 - very important”. The nine competences identified as the most important from the point of view of faculty management and their self-assessment are presented on the radar chart (Fig. 1).

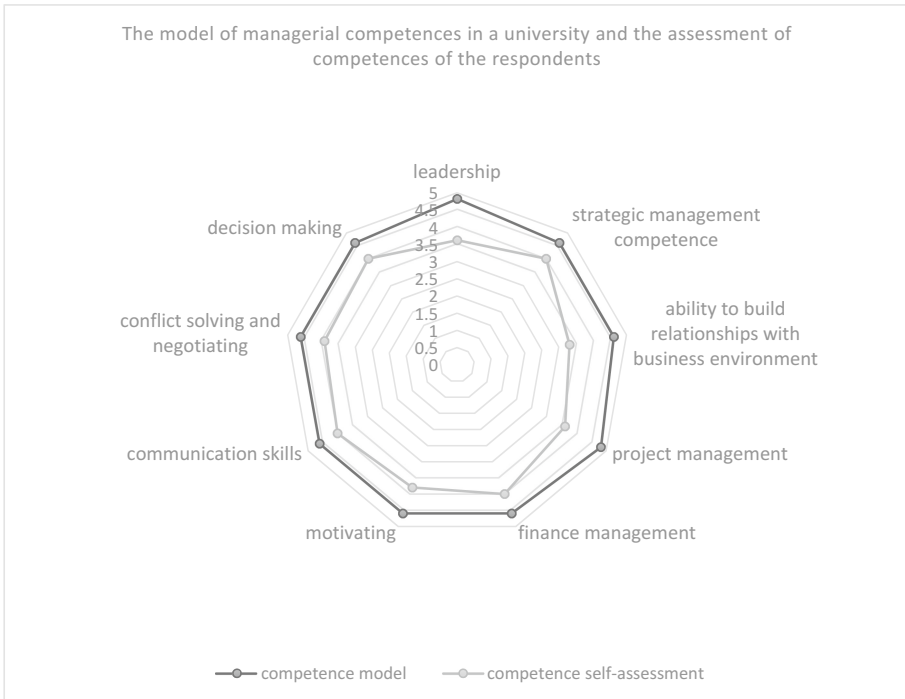


Fig. 1. Competence model of the personnel in charge of faculties at the Vice-Deans’ level and self-assessment of the level of competences held.

The chart presents a competence model as perceived by the respondents and represents the declared level of the selected competences held, and as such is useful in the identification of competence gaps. The widest gaps are to be found in the competence to build relationships with business environment, strategic management, leadership and motivating teams as well as individual subordinates. As regards the latter, the respondents reported a lack of tools that would allow for effective control of the employees’ efforts. Significant competence deficits also affect the ability to inspire, which is a competence strongly connected with leadership. The specific “triad of competence deficits” (building relations with the business environment, strategic management, leadership) may pose a serious threat to the implementation of the

university concepts being developed at present. The respondents emphasized that the current legal regulations limit inventiveness and entrepreneurship and the consequence is a prolonged decision-making process. In addition, they linked deficits in managerial competences with a lack of substantive preparation to perform managerial functions. It was emphasized that their core education path, i.e. engineering in each of the studied cases, left them lacking in key competences necessary for the fulfillment of the managerial role in the university. Additionally, the survey results revealed a lack of knowledge of new management trends, methods and techniques within the fields of project management, strategic management, financial and risk management. It was emphasized that there is a lack of expertise in marketing and effective promotional activities. Effective human resources management also remains a major problem. Attention was drawn to the fact that the management process is becoming more and more complex, which in consequence requires more and more professional management at the university, and a move away from “intuitive management”, which is based on the “trial and error method”. Meanwhile, in the practice of filling managerial positions at higher education institutions, there is no strategy of preparing staff for managerial roles in advance, which should replace the commonly used practice of “throwing people in at the deep end” as could be colloquially described. Faced with radical changes, higher education institutions today require transformational leadership. The aim of the study using the adapted Multifactor Leadership Questionnaire Self (MLQ) was to identify the attitude to leadership style as declared by the surveyed Vice-Deans. The transformational style was characterized with such parameters as: building trust, honesty, inspiring motivation, stimulating innovative thinking of subordinates,

Table 2. Identification of declared leadership styles.

Factors defining leadership styles	Statements	Results achieved
<i>Transformational style</i>		
Confidence building	For the benefit of employees, I will go beyond my own interests	4,3
Inspiring motivation	I present an optimistic outlook for the future	3,4
Honesty	I consider the ethical dimension of the decisions taken	4,0
Stimulating innovative thinking in subordinates	I often ask questions whether the assumptions on the basis of which we operate are correct	3,8
Assuming the roles of a coach and mentor	I help my employees to grow	4,2
<i>Transactional style</i>		
Rewarding achieved results	I keep employees informed about awards for achieved results	4,6
Frequency of rewards for achieved results	I explain the performance criteria that determine rewards	4,3
Monitoring of mistakes made	I keep track of all the mistakes made by employees	4,4

assuming the role of a coach or mentor. Transactional style was defined by such factors as: frequency of rewarding for achieved results and frequency of controlling and holding employees responsible, as well as monitoring the mistakes made. The statements describing particular factors were evaluated on the basis of the five-level Likert scale, where '1' meant *I never use* and '5' - *I always use*. The scale was based on the method of summation of assessments (Table 2).

In assessing the individual parameters identifying the leadership style, the respondents gave high scores for transactional leadership building factors, especially with regard to rewarding results. The lowest level was declared for inspiring motivation, which is a key indicator in identifying the transformational style.

7 Conclusion

Meeting the challenges and expectations of the environment certainly requires that a new paradigm of management at universities be formulated. Universities in the 21st century should become dynamic and entrepreneurial. This necessitates taking risks, observing the environment, recognizing opportunities, taking anticipatory actions, and treating changes as a chance to be seized. However, in relation to the analyzed group, the research confirmed that competence deficits of the management staff may be an important factor hindering the practical implementation of the concept of a dynamic and entrepreneurial university. The study revealed a triad of competence deficits (building relations with the business environment, strategic management, leadership), which characterize rather intuitive management approach, often based on the "trial and error" method, without a clear vision and a consistently implemented strategy. It should be strongly emphasized that the external context in which universities function is changing. As a consequence, higher education must change, even though, as Sharrock observes [19], some academic circles do not recognize or do not want this change. Due to the importance of collegial and advisory bodies, universities are dominated by flexibility of adaptation and inertia, which results in a "delayed response" to the expectations of the environment, and that in a situation where the economic environment expects high reactivity and dynamism of action. Transformation towards an entrepreneurial and competitive university requires strong transformational leadership at every level of university management, which will enable full use of the university's greatest asset, i.e. knowledge and people. The conducted research was of a pilot nature and the results obtained cannot be the basis for generalized conclusions. Therefore, a continuation of the research on larger samples is planned in the future and an extension of their scope through the application of the more developed tool, Multifactor Leadership Questionnaire 360 (MLQ 360). The clear demand for a new type of leadership in universities at each management level also forces the introduction of a new model of the personnel function and a new quality of human resources management and merits further research and analysis.

References

1. Ustawa z dnia 20 lipca 2018: Prawo o szkolnictwie wyższym i nauce. DZ.U. poz.1668 (2018)
2. Spendlove, M.: Competencies for effective leadership in higher education. *Int. J. Educ. Manag.* **21**(5), 407–417 (2007)
3. McNay, L.: From the collegial academy to corporate enterprise: the changing culture of universities. In: Schuller, T. (ed.) *The Changing University?*. SRHE and Open University Press, London (1995)
4. Trow, M.: *Managerialism and the Academic Profession: The Case of England*. Council for Studies of Higher Education, Stockholm (1993)
5. Williams, G., Kitaev, I.: Overview of national policy contexts for entrepreneurialism in higher education institutions. *High. Educ. Manage. Policy* **17**(3), 126 (2005)
6. Du Toit, A.: Making sense through coaching. *J. Manag. Dev.* **26**(3), 282–291 (2007). <https://doi.org/10.1108/02621710710732164>
7. Nanjundeswaraswamy, T.S., Swamy, D.R.: Leadership styles. *Adv. Manag.* **7**(2), 57–62 (2014)
8. Lans, T., Blok, V., Wesselink, R.: Learning apart together: towards an integrated competence framework for sustainable entrepreneurship in higher education. *J. Clean Prod.* **62**, 37–47 (2014)
9. Stankiewicz-Mróz, A.: Approach to the issues of leadership in the processes of companies acquisitions. *Procedia Manuf.* **3**, 793–798 (2015)
10. Amey, M.J.: Leadership in higher education. *Change Mag.* **38**(6), 16–19 (2006)
11. Norris, B.D.: Transformation, diversity and organizational change within institutions of higher education. *S. Afr. J. Educ.* **21**(3), 219–222 (2001)
12. Boyatzis, R.E., Thiel, K., Rochford, K., Black, A.: Emotional and social intelligence competencies of incident team commanders fighting wildfires. *J. Appl. Behav. Sci.* **53**(4), 498–516 (2017)
13. Denison, D., Hooiberg, R., Lane, N., Lief, C.: *Leading Culture Change in Global Organizations. Aligning Culture and Strategy*. Jossey-Bass, San Francisco (2012)
14. Bass, B.M., Avolio, B.J. (eds.): *Improving Organizational Effectiveness: Through Transformational Leadership*. SAGE, Thousand Oaks (1994)
15. Northouse, P.G.: *Leadership: Theory and Practice*. SAGE, Thousand Oaks (2001)
16. Eisenbeiß, S.A., Boerner, S.: A double-edged sword: transformational leadership and individual creativity. *Br. J. Manag.* **24**(1), 54–68 (2013)
17. Wehrich, H., Cannice, M.V., Koontz, H.: *Management*, 12th edn. Mc Graw Hill, New Delhi (2008)
18. Wisniewski, Z., Mnich, J.: A change of approach to management from the functional to the process one – a human factor and an administrative factor in a public university. In: *Advances in Intelligent Systems and Computing*, vol. 605, pp. 164–170 (2018). https://doi.org/10.1007/978-3-319-60828-0_17
19. Sharrock, G.: University management: new finance models need better equipped leaders (2012). www.theguardian.com/higher-education-network/blog/2012/sep/26/university-management-professional-development-australia



Crisis Management and Human Resource Development: Towards Research Agenda

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Abstract. Crisis management has widened as a concept and as a set of practices and in the form of human resource development has become part of a more strategic approach to integrate HR activities and business policies. A strategic approach to HRD is imperative as it involves designing and implementing HRD policies and practices to ensure that a firm's human capital contributes to the achievement of business objectives specified in this globalization era. To ensure the crisis management requires the firm-specific capabilities it must integrate with the high-level strategic integration between HRD, organizational structure, culture, and strategy. This article identifies and discusses a number of themes and trends that together make up the developing research agenda for this field. In reviewing these emerging areas of research, the articles seek to explore some of the implications for HRD practices at both organizational and individual levels.

Keywords: Human resource development · Crisis management · Corporate image

1 Introduction

Human Resource Development (HRD) is one of the greatest assets in every organization, without HRD every business function such as media communications, operations, cash flows and customers dealing will not be completed [1]. HRD is a relatively well-established of practice and is purposefully to develop and improve the condition in which the condition seem almost part of human nature and this is where HRD theory and practice rooted in this developing and advancing perspective [2]. Nevertheless, there are numerous definitions of HRD given by different perspectives from individual researcher to theory perspective and the definition of HRD by country. According to Swanson [2], HRD is a process of developing and unleashing expertise to improve individual, team, work, process and organizational's performance.

Today, crisis management has received much interest in the business concept and has been recognized as an important role in organizational strategy by many business practitioners and academic researchers [3]. Previous studies revealed that organisational response and time are the most important factor in evaluating product harm crisis while other factors such as social responsibility and external factors may influence

consumer purchase intention in a severe crisis [3]. Likewise, many business practitioners share a similar view that organization could manage crises to minimize negative consequences, which may seriously influence the viability of the company [4]. Many of the crisis cases such as Malden Mills demonstrated the importance of establishing effective crisis management and strong communication channel, which may potentially drive positive outcome to organizational and relevant stakeholders [5]. Based on Malden Mills case studies in which the fire have affected the textile firms including the injured 34 workers, destroyed three critical manufacturing buildings have discovered that leadership communication positively influence post crisis communication [6]. The study had also highlighted the importance of strong communication and positive relationship with stakeholders, which influence post-crisis communication [6].

However, as organization becomes more influenced by the multinational, turbulent and technologically complex environment, the need for an organization to align crisis management with business strategy is important to lessen the potential vulnerability to critical resources [7]. Previously, attention was given primarily to the aspect of Human Resource Management (HRM) in crisis management such as employee assistance program and compensation allocations [8]. To date, the role of HRD in crisis management has emerged in the literature [9]. These aligns with [10] studies that crisis management is one of the responsibilities of the HRD who assume the role of strategic partner in every crisis management team. Nevertheless, to date numerous studies on crisis management in HRD highlighted the contribution to planning, preparing and managing organizational crisis, but no in-depth analysis has been taken on HRD role in planning, managing and helping an organization recover after a crisis [8, 11]. Given today's complex environment, the role of HRD should be transformed from being activity based to more result-oriented by focusing on strategic intervention that may benefit the community, employee and organization itself [2]:

HRD is a process of developing and unleashing expertise to improve organizational system, work process, team and individual's performance. HRD efforts in an organization often take place under the additional banners of training and development, organizational development, performance improvement, organizational learning, career development and leadership development (p8)

In order for such a transformation to occur, a strategic approach to emphasize HRD in contributing to crisis management is imperative. When the organization does not have a strategic role-play in the organization, the HRD knowledge of learning and performance may not be applied and learning may be difficult to achieve [12]. For crisis management to be put into practice, it requires the development of firm-specific capabilities, learning, and performance that enable stakeholders to identify, recover, and respond from crisis [9]. This was supported by previous studies [13] that by aligning learning, change and performance with organizational strategy, organization may gain stakeholder support and ensure successful implementation across organizational units. Similarly, HRD and crisis management scholars engaged in research in shared theoretical, which include human capital, critical, economic, psychological and strategic, thinking [13]. Both disciplines work differently but shared the same goals, which is to be aware on the impact of the organization on individual, community and society. For crisis management discipline, their role is to protect and support the key organizational

stakeholders, resources and community whereas HRD is to develop the intellectual, emotional and skill-based capabilities to perform various types of work [14].

Therefore, between these two disciplines HRD and crisis these two disciplines and implication for research and practice yet to be explored. Crisis theories and literature debates on crisis seemed to focus on the management itself, but ignore the core element of the crisis, which is the human resource. Therefore, this study explores the way HRD may achieve organizational capability and learning that will enhance organization flexibility, confidence and capacity to deal with unexpected events should it arises. The primary purpose of this article is to explore the role of HRD in organizational crisis management. As mentioned in the previous studies, although there are broader roles and function of HRD, this study focuses more on the role of HRD on leadership and training development, organizational culture, communication and also learning in supporting change and improvement in individuals in managing organizational crisis. Specifically, this article reviews the theoretical underpinnings of HRD research, identifies opportunities for HRD to enhance crisis management efforts and explores how HRD research and practice may contribute to support and promote organizational crisis management efforts. The aim of this paper is to explore the HRD role in managing crisis in organizations. The research question for this study are as follows (1) How did the crisis happen? (2) How did the company handle the crisis? (3) What is the outcome from HRD's intervention in the crisis?

2 Literature Review

2.1 Theoretical and Disciplinary Foundations of HRD

HRD as a discipline is broader than any single theory. In [2] studies states that HRD is drawn from multifaceted theories and integrate them in a unique manner for the purpose of HRD. The theory is important as it explains what a phenomenon is and how it works. According to [15] a discipline is a body of knowledge that involve its own organizing concepts, codified knowledge, epistemological approach, particular methodologies, undergirding theories and technical jargon. Thus, having well-defined core HRD theories may inform HRD research or the development of specific practitioner tools and methods. In line with crisis management efforts, the theories that provide great stability for HRD as a discipline and field of practice required to function in an uneven condition or crisis is the three-legged stool as visually portrayed in Fig. 1. The legs represent the component theory realms and the stool represents the full integration of the three components into the unique theory of HRD [2]. The three-legged stool contains three core elements, which is the psychological theory, economic theory and system theory. Psychological theory captures the core human aspects of developing human resources as well as socio-interplay of human and system, economic theory is the utilization of resources to meet productive goals in a competitive environment and system theory captures the complex and dynamic interaction of environment, organization, process, group and individual variables operating at any point in time.

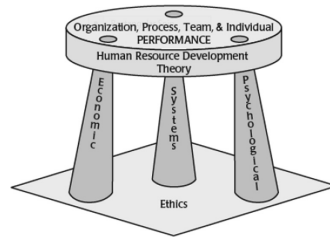


Fig. 1. The theoretical Foundation of Human Resource Development (Swanson [2], p. 102)

From this line of inquiry, the HRD theory above provides a useful understanding of how each theory may influence the organization, process, team and individual's performance. This research discusses the organization's contribution to the crisis and how it manages the crisis from descriptive point of view to a more critical approach in consideration to how organizational strategy, culture, communication may contribute to crisis development. This theory aligns with the mission of HRD and its role to enhance crisis management. Many HRD scholars agree that with the emergence of diverse philosophical and theoretical assumptions [2], HRD mission continues to focus on developing intellectual capital and supporting the organizational change to maximize the benefit for the individual, organizational, community and nations [16]. For instance, all leaders have their own leadership style in leading an organization. However, placing the wrong leaders during a crisis may lead to catastrophic result. Therefore, it is very important to advance the goal of HRD theory in practice to identify the leaders who are skillful, under condition of great uncertainty, time, pressure and stress and their capabilities in other function because of their position or knowledge. In the context of crisis, it is important for the HRD role to link their role as a strategic partner in the organization because in time of crisis there is no time to create new knowledge, effective decision-making, risk taking and communication [20].

2.2 Linking Leadership and Training, Organizational Strategy, Structure and Culture, Learning and Crisis Communication with Crisis Management Research

Previously, most of the past studies on crisis management have explained how crisis influence all the phases in the crisis management steps, however there is limited research that identifies the knowledge, skills or abilities of leaders and employee in leading the organization through all these phases [20]. Leaders play a key role in this process as they focus their attention to the repair and transformation of the organization [17]. Moreover, top management's involvement is important in developing a systematic strategy in crisis management to convince others in the organization to cooperate [19]. Although many organizations realize the consequences and the negative impact associated with the crisis, yet there are formal training and on the job-related activities that do not prepare them for crisis management. In this modern business environment, communication and public relation is also considered as one of the first criteria in crisis management and not just involve sense-making, taking risk, managing the crisis and

others [20]. However, previous research on leadership and crisis management research shows that the research on the involvement of leaders in crisis situations are still left unattended [18]. Thus, it is crucial for the organization to require leaders to adopt a complex set of competencies, which include but not limited to communicating effectively to lead the organization through success recovery in every phase of the crisis phases [21].

Another area that is also a fundamental role of HRD is to develop human resources through training and development activities. Training refers to the abilities of an organization to provide the employee with learning relating to their work-related competencies. However, it is crucial for the employee to possess some competencies such as their abilities, knowledge and skills that potentially create successfully in performance [22]. In this regard, by giving training it may enable the employee to create the working condition that encourages continuous learning is through the high leverage training practices. This continuous learning allows the employees to understand their entire work systems, which associated with the connection surrounding their jobs, their work units and the company. One of the factors that contributes to the occurrence of a crisis is human error. Within a crisis environment, it is paramount for every organization to build a knowledge base of crisis and the capability of coping with it. As [9] noted, this may be done through training because it is an effective tool to eliminate, reduce the impact of crisis such as through technology and human errors. Empirical studies have confirmed that training and development do have a significant positive influence in enhancing crisis situations [23–25]. For instance, in [25] studies have investigated the long term effects of a simulation-based training in anesthesia crisis management where this study has distributed a questionnaire to all the anesthesiologists and the result showed that 69% of the respondents perceived there is a change in practice and improvement in interaction between team members and also enhancement in problem-solving in preventing and managing crisis. On that account, it is the HRD professional's crucial role in educating the leaders and members on the change in management process and seeking the appropriate development interventions to cope with the crisis [1].

Another area that is certainly important for a HRD to make a big impact is in fostering crisis-prepared organizational culture. Earliest researcher's defined organizational culture as a mechanism through which effort is integrated through the coordination of activities and also described as a mechanism that direct behavior towards achieving shared values, goals and norms [26]. The organizational culture believes to be one of the major predictors of crisis situations because it represents shared beliefs on issues such as risk and organizations vulnerability to crises [27]. However, how to create an organizational environment with crisis-prepared mentality situations is a major task for the HRD professionals. Such culture can be created through training interventions and through teaching the leaders and members to constantly assessing organizations practices and look for sign [28]. For instance, one study done by [27] proposes that by combining the elements of organizational culture with individual leadership style it may allow the organization to match a given crisis with the best possible crisis response leader. This successful implementation approach was present in a real-world case study of the U.S Airforce Taiwan-4 crisis. Based on the crisis case study, the result shows that culture plays an important role in the development and managing crisis and the crucial

role of leaders in crisis management does matters. It is important for the organization to consistently prepare for crisis response by knowing the organization's culture and leaders and monitoring the crisis management based on crisis environment, organizational culture and leadership style to select the right leader for the crisis [27].

Furthermore, another area that HRD professional can facilitate change and prepare organizational culture is through promoting organizational learning (OL) [29]. Organizational learning has been defined in so many different ways, however the earliest definition [30] who recognized OL as the acquisition of new knowledge and the translation of this knowledge into a more effective organizational action. However, recent studies have introduced a new concept of learning referred to Learning in Crisis (LiC) which draws upon the theoretical relationship between OL and CM [31]. LiC introduces new ways of learning by engaging leaders in learning not only during crisis but to engage in reflexive critique as part and parcel of their everyday practice. By doing this, they become more aware of the learning traps they can fall into unintentionally which might encourage them to be mindful of the lessons they seek to distill and have as a basis of their learning. Moreover, it will prompt them to be aware of the judgments that inform their actions and be more accountable and responsible as they experiment the possibilities they create while practicing [31].

Learning intervention may guide the organization to establish effective crisis communication system through development of individual critical thinking and reflection skills, enhancement of their organizations crisis knowledge base and encouragement of double loop learning [34]. Despite the importance of learning in the prevention and preparation in crisis phases, it is also important for organization to identify new learning opportunities arising from crisis situation that is also one of the central areas whereby HRD research may involve stakeholders in reflective learning opportunities to redesign system and process that may have failed [9]. Action learning and evaluative inquiry is the common analysis HRD method that may help stakeholders identify and process crisis situations to enhance ongoing CM procedures [29].

The other area that is also a crucial role that must be considered is communication within the organization itself. The ability to communicate effectively is deemed to be the most closely identified competency in crisis management [20]. Communication is important because it shapes the stakeholder's perception of the crisis and the organization [20]. Specifically, the role of communication in a crisis is during the damage control or the containment phase and leaders will communicate with the organization personnel and provide information and instruction and store a calm or provide assurance to the respective constituents. It is important for leaders at this phase to be confident, persuasive or emphatic in their messages.

Moreover, a leader's competency in communicating effectively depends on his or her ability to connect emotionally and psychologically with the audience [32]. Based on Coca-Cola crisis experience crisis, they are lacking transparency in handling the crisis and communicated messages that were interpreted to be defensive. The Coca-Cola crisis has affected their brand and reputation suffered in the press due to its denial stance [20]. However, through apologies, empathy and emotional appeals, the leaders were able to connect with their audience in a way that worked to the organization advantage's and at the same time the communication consistent with the organization interest in putting the patient or customer first [33]. Synthesizing on the literature

review, an integrated framework of the variable that explains the role of HRD in crisis is depicted in Fig. 2.

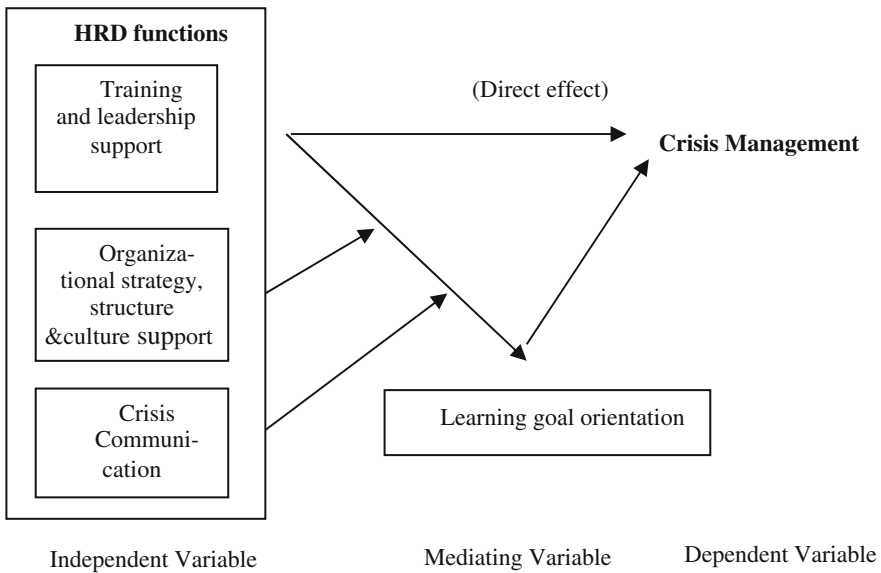


Fig. 2. Schematic diagram of the integrated conceptual framework

Figure 2 is developed to guide the exploration of the role of HRD in the context of organizational crisis management. HRD emphasized exploration, the extent to which the HRD activities horizontally integrated with the crisis management. The activities of HRD will focus on the internal development competencies and short term competencies. Organization may enhance their focus in these HRD activities by implementing initiatives such as skills training, socialization process and performance and management activities directed to enhance organizational crisis management [35].

3 Objective

The objective of the research is to explore the role of HRD in crisis management in an organization. There are several benefits in implementing HRD roles in enhancing crisis management as a crucial part in every organization to ensure organizations reputation, growth and stability.

4 Research Methodology

The primary approach for this study is to capture the richness of the organizational experiences with the crisis and how they deal with the crisis with a specific focus on HRD intervention in response to crisis management efforts. The important reason this

study for the HRD researcher and practitioner is to consider how to endorse their role specific focus on crisis management, the HRD theory provides a blueprint for the organization to understand how the HRD role may influence the organization performance in response to crisis management, but also how the HRD intervention may influence the role of stakeholders and the organizational culture in terms of acceptance, implementation and evaluation. Therefore, the choice of suitable methodology is very important since it determines the techniques to be employed for the research study.

In this study, one possible way to understand and investigate the central question that is commonly engaged by an enterprise exploring the role of HRD interventions in crisis management is to ascertain what was happening in the area of discipline. As such, the proposed research methodology for this study is qualitative because of its commitment to an exploration of the socially constructed nature of reality. Qualitative strategy encourages participatory knowledge, allows for a thorough explanation of the research questions, puzzles and ideas that may enhance understanding of the context of the specific nature of HRD employed by the participants [36]. Besides that, the qualitative research is a flexible approach, as it allows adaptability to change, that may help the researcher to delve deep into the HRD activities engaged by the organization with the help of prompt questions. Therefore, the choice for techniques under the qualitative approach employed to generate data to answer the above research aims will be the interview. According to Lewis [37], interview refers to a discussion between two people that allows for the exchange of information and ideas through questions and responses to reach a joint construction meaning of a particular topic in communication. This method is useful when how and why questions are posted.

5 Research Propositions and Expected Result of the Research

5.1 Academic Field

By far, the less developed is the emerging concept of the link between HRD practices in crisis management [38]. According to Nizamidou and Vouzas [10], it is the responsibility of the HRD to ensure that everyone including the employees in the organization to be fully aware of the negative and indirect impacts of crisis events and emphasize their HRD practices during the crisis and bring back situation to normalcy. As such, in this study, the link between crisis management and HRD will be explored and how HRD can contribute to the development of operational capability and enhance the capability to learn both during and after the crisis. By doing this, the study will provide full richness of the involvement of HRD in the basis of attaining crisis management objectives and goals. Moreover, the theories of crisis management may expand their ways of handling their crisis situation through incorporation with the HRD activities. Our framework for this study may add a particular way to learn and the capability to overcome crisis issues in the future.

5.2 Business and Organization Development

Crisis management is not a one-way activity but it is a process of human action and interaction of knowledge in the organization. This study demonstrates that if organization and leaders effectively pay attention to the HRD role and develop skills to prevent and effectively respond to crisis and other strategic issues and make them as part of their organizational routines, the organization will be able to create organization with common goals, manage firm reputation brand and financial security. Therefore, a more comprehensive view on HRD and crisis management is obviously required for the purpose of the present study especially by examining the role of HRD in crisis management initiatives. This study will contribute to the research results that are responsive to local Malaysia organization rights, needs and interest.

6 Conclusions

Based on a comprehensive literature review, this research innovatively provided an integrated conceptual framework and explained the factors of HRD role in crisis management. Given today's globalization, organization are highly prone to external shocks, which are inherently unpredictable and required for the essential of crisis management as an integral part of the organizations operations. This multiple exposure of threats cannot be simplistically achieved with quick fixes to ensure the successful integration at the sectoral, organization and individual level. However, it requires a deep organizational learning and reflection to meet the complexity of such threats. HRD preparation for crisis management should be a key role in every aspect of crisis management effort.

Subsequently, the demand for HRD in protecting the assets and people in the organization is high in national and international context. Therefore, quality HRD initiatives is a vital aspect of any conceived and executed crisis and management strategy. As a conclusion, this study believes that HRD's ability to respond and manage crisis may have a significant impact in the short and long-term survival and should be taken as one of the important parts in crisis management initiatives.

References

1. Haslinda, A.: Evolving terms of human resource management and development. *J. Int. Soc. Res.* **2**(9), 180–186 (2009)
2. Swanson, R.A., Holton, E., Holton, E.F.: *Foundations of Human Resource Development*. Berrett-Koehler Publishers, San Francisco (2001)
3. Vassilikopoulou, A., Lepetos, A., Siomkos, G., Chatzipanagiotou, K.: The importance of factors influencing product-harm crisis management across different crisis extent levels: a conjoint analysis. *J. Target. Meas. Anal. Market.* **17**(1), 65–74 (2009)
4. Jin, Y., Liu, B.F., Austin, L.L.: Examining the role of social media in effective crisis management: the effects of crisis origin, information form, and source on publics' crisis responses. *Commun. Res.* **41**(1), 74–94 (2014)

5. Alpaslan, C.M., Green, S.E., Mitroff, I.I.: Corporate governance in the context of crises: towards a stakeholder theory of crisis management. *J. Conting. Crisis Manag.* **17**(1), 38–49 (2009)
6. Ulmer, R.R.: Effective crisis management through established stakeholder relationships: Malden Mills as a case study. *Manag. Commun. Q.* **14**(4), 590–615 (2001)
7. Lauras, M., Trupitl, S., Bénaben, F.: Towards a better management of complex emergencies through crisis management meta-modelling. *Disasters* **39**(4), 687–714 (2015)
8. Lockwood, N.R.: SPHR: Crisis management in today's business environment. *SHRM Res. Q.* **4**, 1–9 (2005)
9. Hutchins, H., Wang, J.: Organizational crisis management: unexplored territory in HRD. *Adv. Dev. Hum. Resour.* **10**(3), 310–330 (2008)
10. Nizamidou, C., Vouzas, F.: MHR. Providing a new perspective in HR in terms of crisis management. *Int. J. Bus. Sci. Appl. Manag.* **13**(1), 15–25 (2018)
11. Hutchins, H.M., Annulis, H., Gaudet, C.: Crisis planning: survey results from Hurricane Katrina and implications for performance improvement professionals. *Perform. Improv. Q.* **20**(3–4), 27–51 (2008)
12. Hamlin, B.: HRD and organizational change: evidence-based practice. *Int. J. HRD Pract., Policy Res.* **1**(1), 7–20 (2016)
13. McGuire, D., Garavan, T.N., O'Donnell, D., Watson, S.: Metaperspectives and HRD: lessons for research and practice. *Adv. Dev. Hum. Resour.* **9**(1), 120–139 (2007)
14. Torraco, R.J.: *Human Resource Development Transcends Disciplinary Boundaries*. SAGE, Thousand Oaks (2005)
15. Chalofsky, N.: *Human and Organization Studies: The Discipline of HRD*. Online Submission (2004)
16. Mitsakis, F.V., Aravopoulou, E.: The impact of the economic crisis upon human resource development (HRD): evidence from two Greek banks. *Int. J. Hum. Resour. Dev.: Pract. Policy Res.* **1**(2), 67–82 (2016)
17. Sommer, S.A., Howell, J.M., Hadley, C.N.: Keeping positive and building strength: the role of affect and team leadership in developing resilience during an organizational crisis. *Group & Organ. Manag.* **41**(2), 172–202 (2016)
18. Schoenberg, A.: Do crisis plans matter? A new perspective on leading during a crisis. *Public Relat.S Q.* **50**(1), 2 (2005)
19. Williams, T.A., Gruber, D.A., Sutcliffe, K.M., Shepherd, D.A., Zhao, E.Y.: Organizational response to adversity: fusing crisis management and resilience research streams. *Acad. Manag. Ann.* **11**(2), 733–769 (2017)
20. Wooten, L.P., James, E.H.: Linking crisis management and leadership competencies: the role of human resource development. *Adv. Dev. Hum. Resour.* **10**(3), 352–379 (2008)
21. Johansson, C., Bäck, E.: Strategic leadership communication for crisis network coordination. *Int. J. Strat. Commun.* **11**(4), 324–343 (2017)
22. Noe, R.A., Hollenbeck, J.R., Gerhart, B., Wright, P.M.: *Fundamentals of human resource management* (2007)
23. Gaba, D.M., Howard, S.K., Fish, K.J., Smith, B.E., Sowb, Y.: Simulation-based training in anesthesia crisis resource management (ACRM): a decade of experience. *Simul. Gaming.* **32**(2), 175–193 (2001)
24. Reznick, M., Smith-Coggins, R., Howard, S., Kiran, K., Harter, P., Sowb, Y., et al.: Emergency medicine crisis resource management (EMCRM): pilot study of a simulation-based crisis management course for emergency medicine. *Acad. Emerg. Med.* **10**(4), 386–389 (2003)
25. Weller, J., Wilson, L., Robinson, B.: Survey of change in practice following simulation-based training in crisis management. *Anaesthesia* **58**(5), 471–473 (2003)

26. O'Neill, J.W., Beauvais, L.L., Scholl, R.W.: The use of organizational culture and structure to guide strategic behavior: an information processing perspective. *J. Behav. Appl. Manag.* **2** (2), 816 (2016)
27. Bowers, M.R., Hall, J.R., Srinivasan, M.M.: Organizational culture and leadership style: the missing combination for selecting the right leader for effective crisis management. *Bus. Horiz.* **60**(4), 551–563 (2017)
28. Dhar, R.L.: Service quality and the training of employees: the mediating role of organizational commitment. *Tour. Manag.* **46**, 419–430 (2015)
29. Trehan, K., Rigg, C.: Critical action learning research; opportunities and challenges for HRD research and practice. In: *Handbook of Research Methods on Human Resource Development*, p. 155. Edward Elgar, Cheltenham (2015)
30. Kim, D.H.: The link between individual and organizational learning. In: *The Strategic Management of Intellectual Capital*, pp. 41–62. Elsevier (1997)
31. Antonacopoulou, E.P., Sheaffer, Z.: Learning in crisis: rethinking the relationship between organizational learning and crisis management. *J. Manag. Inq.* **23**(1), 5–21 (2014)
32. Mileti, D.S., Beck, E.M.: Communication in crisis: explaining evacuation symbolically. *Commun. Res.* **2**(1), 24–49 (1975)
33. Seeger, M.W.: Best practices in crisis communication: an expert panel process. *J. Appl. Commun. Res.* **34**(3), 232–244 (2006)
34. Fink, L., Yogev, N., Even, A.: Business intelligence and organizational learning: an empirical investigation of value creation processes. *Inf. Manag.* **54**(1), 38–56 (2017)
35. Garavan, T.N., Gunnigle, P., Morley, M.: Contemporary HRD research: a triarchy of theoretical perspectives and their prescriptions for HRD. *J. Eur. Ind. Train.* **24**(2/3/4), 65–93 (2000)
36. Hakim, C.: *Research Design: Strategies and Choices in the Design of Social Research*. Allen and Unwin, London (1987)
37. Lewis, S.: Qualitative inquiry and research design: choosing among five approaches. *Health Promot. Pract.* **16**(4), 473–475 (2015)
38. Zavyalova, E.K., Kucherov, D.G., Tsybova, V.S.: Approaches to HRD in Russian IT-companies in the period of economic crisis. *Hum. Resour. Dev. Int.* **21**(4), 1–21 (2018)



The Economics of Intangible Assets: From just Value-to-Value Creation

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Abstract. “What can be measured can be managed.” This managerial rule supposes that every measured resource is automatically managed. The literature shows the difficulties to measure the human capital as an internal resource. At the same time, this intellectual capital is the most important in the creation value for the company. Indeed, this managerial approach seeks to find the best way to explore how to create value by investing in the intellectual capital. In contrast, the accounting approach, ignore the importance of the intellectual capital as intelligible assets. This paper will present the difference between the managerial approach and the accounting approach of the intangible assets and how could this difference influence the decision of companies.

Keywords: Intangible assets · Intellectual capital · Managerial approach · Accounting approach

1 Introduction

Effective management of assets is the key to return on investment. Thus, in order to remain competitive and maximize shareholder value, organizations must become more effective and efficient in the management of their assets. There are four groups of assets identified into financial capital, human capital, intellectual capital and social capital. In the economics of knowledge, human capital is treated as one of the critical internal resources in organizations [1]. The human capital is tangible assets and can be measured. In contrast, intellectual capital is an intangible, and it refers to the flowing examples: best practices, experience, and process generation. Therefore, intellectual capital management aims to achieve strategic goals by focusing on the tactical management of intangible assets [2], but the lack of ability of information systems to identify, measure and control intangible assets lead managers to failure in detecting, exploiting and managing of the intellectual capital inside organizations [3].

From the literature review, definitions related to intellectual capital management mostly were based on the importance of the concept of value. By examining the various definitions, the intellectual capital management is about all mechanisms of creation, extracting and maximizing value [1, 4–25].

According to Jones [26], the accounting system fails to record and present relevant information of intellectual capital and it can be regarded as inadequate as a source of information for control and decision-making. This information is lacking the importance of the value created by the human assets and the real value of people to organizations. For Jones [26], the difficulty for organizations is to measure if the value of the human assets is increasing or decreasing even if it is being used effectively by the firm. In addition, the investment of human assets stands at a high level because of the advance of technology, the shortage of skilled personnel and complexity of organizations.

2 The Value Creation of Intangible Assets in the Managerial Approach

From the literature review, the concept of intellectual capital had various definitions and theories developed so far. Thus, the intellectual capital is an interdisciplinary domain that gives a diversity of meanings and interpretations. Indeed, in managerial approaches, it refers to intangibles resources that determine the value of an organization, and the competitiveness of an enterprise [27]. Therefore, intellectual capital is knowledge of an enterprise accumulated by their human capital and cannot be accurately measured. Thus, companies have to develop methods of increasing corporate value by using effective intellectual capital management. Innovation and knowledge are driven by intellectual capital become the key to corporate success, especially in the knowledge-based industry [28]. For Roos et al. [29] IC is classified as structural and human capital, thinking and non-thinking assets and it needs different management approaches than other types of capital. IC is an invisible assets of organization which include: employee competence and their capacity to face variety of situations such internal structure (e.g. management, structure patents, concepts, models, research and development capacity and software) or external structure (e.g. image, brands, customers and suppliers relations).

Hence, IC is an intellectual material that remains to the ability [19] of creating new knowledge and how it can be used to create wealth [30]. It also refers to what human can do individually and collectively within the organisation or outside it (e.g. relationships of the organization with suppliers, distributions and customers). Previous studies have recognized IC as components of market assets, system, human-centred assets intellectual property [31, 32]. These invisible assets include intangible resources presented in Fig. 1 that contribute to the creation of value for the organization need to be well measured in each situation.

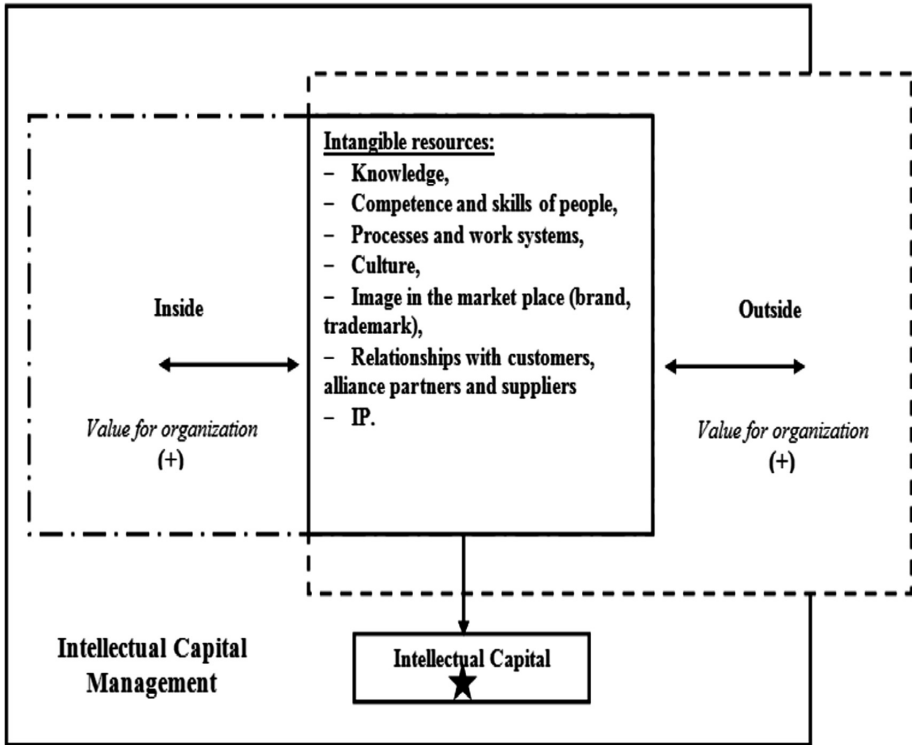


Fig. 1 Components of intellectual capital and value creation in the ICM

In order to be more competitive in the knowledge economy, the organization needs an increasing use of intangible assets. For Shakina and Barajas, [33] the key feature of intellectual capital is its ability to enhance the effectiveness of other resources, including tangible assets. Therefore, the authors affirm the existence of a close connection between the modern concepts of value-based management and intellectual capital.

The real contribution of intellectual capital to the organization’s value can be measured if only we adopt efficient indicators based on intellectual capital outcomes limited in time with a cost-reducing approach. Thus, the value created is now clear, and organizations have to use benchmark from competitors in two positions, such the internal or external value added. Firstly, internal value is about all intangible resources that exist within the organization, and can be recycled internally due to the contribution of a professional employee (stars) and transmitted to others employees in a nested circle.

This value creation is from the inside of the organization and needs intellectual capital management based on detecting and promoting target talented people. Secondly, and complementary to the internal value, the external value is the image of the organisation vis-à-vis other and itself. When we talk about the organization’s external value we mean how efficient is this organisation in attracting profits and perduring

loyalty's clients. Indeed, even if this value is from the outside, the external value is based on the abilities of intellectual capital to respond to the market needs. Thus, this is the role of the professional employee (stars) to increase external value using succeeded human multidimensional interactions. We believe that effective intellectual capital management based on a real combination between the internal and external dimension of value involves to the organization the challenge of managing intellectual capital selectively in a peaceful social climate far from conflicts of interest. The problem is how to guarantee the best selection of talented target employee and to reach equity between professional employees without losing the level of motivation.

The economy of value brings new human constraint to the organisation that complicated the mission of intellectual capital management. Conscious by its own contribution value-added to the organisation, the employee that constitute the intellectual capital become more exigent in term of valorization and career management. Therefore, organization risk to lose its intangibles assets created and developed by the professional employee if they leave from the organization to the competitors. In this situation, the intellectual capital management is oriented to consider the intangible assets especially intellectual capital as a real capital with future gains and risk. In this dynamics, many organizations have done it without realizing that they are adopting an intellectual capital management approach.

3 The Intangible Assets in the Accounting Approach

In the accounting approach [IAS 38], the intangible assets are long lived assets used in the production of goods and services. They are characterized by their physical lack and represent a legal right. In addition, they represent a competitive advantage created or acquired by the proprietor. Thus, *IAS 38 Intangible Assets* outlines the accounting requirement for intangible assets, which are non-monetary assets, without physical substance and identifiable (either being separable or arising from contractual or other legal rights). Since February 1977, IAS 38 history had begun by the exposure of the draft E9 Accounting for Research and Development activities. In March 2004, IAS 38 was revised and applies to intangible assets. The objective of IAS 38 is to prescribe the accounting treatment for intangible assets that are not dealt with specifically in another IFRS. The IAS 38 applies to all intangible assets other than [IAS 38.1]:

- *Financial assets,*
- *Exploration and evaluation assets,*
- *Expenditure on the development and extraction of minerals, oil, gas, and similar resources*
- *Intangible assets arising from insurance contracts issued by insurance companies.*
- *Intangible assets covered by another IFRS, such as (IRFS 5, IAS 12, IAS17, IAS19, IFRS 3).*

From the IAS 38 [34, p. 339], [35, p. 89], the intangible assets are defined as an identifiable non-monetary asset without physical substance and it include the flowing examples: *computer software, patents, copyrights, motion picture films, customer lists, mortgage servicing rights, fishing licences, import quotas, franchises, customer or*

supplier relationships, customer loyalty, market share and marketing rights. Generally, it can be found in two situations (research and development). Firstly, the research concerned all original and planned investigation undertaken with the prospect of gaining new scientific or technical knowledge and understanding. The intangible assets are considered as an investment in a new knowledge research activities. The IAS 38 gives the following examples:

- *Activities aimed at obtaining new knowledge.*
- *The search for alternatives for materials, devices, processes, products, systems or services.*

Secondly, the development is the application of research findings or other knowledge to a plan or design for the production of new or substantially improved materials, devices, products, processes, systems or services prior to the commencement of commercial production or use. In this second situation, the intangible assets are all activities of developing or pre-producing prototypes and models, exactly the development of tools and materials used in production. The IAS 38 gives the following examples:

- *The design, construction, and testing of pre-use or pre-production prototypes and models.*
- *The design of tools and dies involving new technology.*
- *The design, construction, and operation of a pilot plant that is not of a scale economically feasible for commercial production.*

From intangible assets definition [IAS 38.8], there are three critical attributes: identifiability [IAS 38.12], control and future economic benefits. The intangible assets are identifiable when it is separable or arises from contractual or other legal rights, regardless of whether those rights are transferable or separable from the entity or from other rights and obligations. Thus, intangible assets are capable of being separated and sold, transferred, licensed, rented, or exchanged, individually or together with a related contract. Besides, they can be acquired by separate purchase, as part of business combination, by a government grant, by exchange of assets, by self-creation (internal generation). It is generally accepted that in the accounting approaches, expenditure to acquire and develop human resources has conventionally been regarded as an expense and not as an asset because conventionally the concept of an asset has not covered such expenditure [26]. In contrast, this expenditure can produce a value which can yield long-run benefits to the organization. Thus it is admitted that the human assets have a probability to be considered as investment but with a high level of risk. The problem is that human assets could not be evaluated as a machine or other assets. Until human have not a fair value, it is difficult to consider them as an asset or report them to the balance sheet, for the accounting approach, the humans could not be sold in the market. This condition excludes the human assets from accounting treatment. It is easier to consider them expenditure and reduce the risk of the fair value. On the other hand, market gives a fair value for professional football players. From the fact that clubs spend more money on player acquisitions, player registrations, therefore players are considered intangible assets and represent a significant part of the total assets of major European football clubs [36].

According to Schotté [37] clubs “buyers” and clubs “sellers” can exchange football players at a fixed price on a market, considering that the same club can occupy both roles successively. This situation is inseparable from the fact that players are considered in accounting terms as assets of the club. From this point of view, there is no opposition between economic logic and sports logic when club manager invests in their human assets to improve the performance of their team. In addition, the price of a player does not exist before the exchanges, it depends on the value that the various potential buyers grant him on the basis of a shared belief. Thus, these players can be exchanged for very large sums when the clubs’ managers believe in the virtues of their transfers. Over the past decade’s standards of accounting have changed significantly from historical cost accounting to promote market value accounting in order to communicate an up-to-date value of companies’ balance sheet to investors and other stakeholders [38].

4 Conclusion

The main goal of this paper is to describe why an organization should pay attention and manage intellectual capital even it doesn’t excite in the accounting approach, especially when intellectual capital is considered as a hidden intangible asset [39]. An organization becomes more powerful if it creates value by transforming their intellectual capital into new processes, products and services.

Thus, the organization recognized that the intellectual capital or intangible assets were the most important assets of many of the world’s largest and most powerful companies; it is the foundation for the market dominance and continuing profitability of leading corporations [17]. On the other hand, corporations sometimes choose not to focus on value creation and, instead, unintentionally make decisions that systematically decrease the long-term value of their businesses [17]. Indeed, financial accounting systems ignore this hidden value, created by an unidentifiable, unseparable and uncontrollable intangible assets.

Our reflection is that the time comes to move from fair value-to-value creation by adopting effective intellectual capital management based on the dynamic of creating value in a nested circle. A further contribution of the research is to test and validate the model of value creation in the ICM based on value creation indicators of high R&D in the small and medium enterprises. More research is required to develop a deeper understanding of the relationships between intellectual capital starts and the increase of value creation internally and externally.

References

1. Wong, K.-L., Tan, P.S.-H., Ng, Y.-K., Fong, C.-Y.: The role of HRM in enhancing organizational performance. *Hum. Resour. Manag. Res.* **3**(1), 11–15 (2013)
2. Connell, B., Brennan, N.: Intellectual capital: current issues and policy implications. *J. Intellect. Cap.* **1**(3), 206–240 (2000)
3. Joia, L.A.: Measuring intangible corporate assets: linking business strategy with intellectual capital. *J. Intellect. Cap.* **1**(1), 68–84 (2000)

4. Berzkalne, I., Zelgalve, E.: Intellectual capital and company value. *Procedia Soc. Behav. Sci.* **110**, 887–896 (2014)
5. Contractor, F.J.: Valuing corporate knowledge and intangible assets: some general principles. *Knowl. Process. Manag.* **7**(4), 242–255 (2000)
6. Corona, C.: Dynamic performance measurement with intangible assets. *Rev Account Stud.* **14**(2), 314–348 (2009)
7. Dahmash, F.N., Durand, R.B., Watson, J.: The value relevance and reliability of reported goodwill and identifiable intangible assets. *Br. Account. Rev.* **41**(2), 120–137 (2009)
8. Eckstein, C.: The measurement and recognition of intangible assets: then and now. *Account. Forum* **28**(2), 139–158 (2004)
9. Garavan, T.N., Gunnigle, P., Collins, E., Morley, M.: Human capital accumulation: the role of human resource development. *J. Euro Ind. Train.* **25**(2/3/4), 48–68 (2001)
10. Hwang, Y., Chen, M., Cheng, S.: An empirical investigation of the relationship between intellectual capital and firms' market value and financial performance. *J. Intellect. Cap.* **6**(2), 159–176 (2005)
11. Guthrie, J., Petty, R.: Intellectual capital literature review: measurement, reporting and management. *J. Intellect. Cap.* **1**(2), 155–176 (2000)
12. Jusoh, R., Asiaei, K.: A multidimensional view of intellectual capital: the impact on organizational performance. *Manag. Decis.* **53**(3), 668–697 (2015)
13. Kirk, R.J.: Chapter 3 - Asset valuation: intangible assets. In: Kirk, R.J. (ed.) *IFRS: A Quick Reference Guide*, pp. 88–127. CIMA Publishing, Oxford (2009)
14. Kitts, B., Edvinsson, L., Beding, T.: Intellectual capital: from intangible assets to fitness landscapes. *Expert Syst. Appl.* **20**(1), 35–50 (2001)
15. Kucharčíková, A.: Managerial approaches to understanding the human capital. *Hum. Resour. Manag. Ergon.* **7**(1), 33–44 (2013)
16. Liepė, Ž., Sakalas, A.: Evaluation of human capital role in the value creation process. *Procedia Soc. Behav. Sci.* **156**, 78–82 (2014)
17. Lin, G.T.R., Tang, J.Y.H.: Appraising intangible assets from the viewpoint of value drivers. *J. Bus. Ethics* **88**(4), 679–689 (2009)
18. Marr, B., Schiuma, G., Neely, A.: Intellectual capital—defining key performance indicators for organizational knowledge assets. *Bus. Process. Manag. J.* **10**(5), 551–569 (2004)
19. Mayo, A.: The role of employee development in the growth of intellectual capital. *Pers. Rev.* **29**(4), 521–533 (2000)
20. Carlo, M.: Measuring the value of firms with intangible assets: what is learned from experience. *Strat. Chang.* **19**(3–4), 177–182 (2010)
21. Nimtrakoon, S.: The relationship between intellectual capital, firms' market value and financial performance. *J. Intellect. Cap.* **16**(3), 587–618 (2015)
22. Pike, S., Roos, G., Marr, B.: Strategic management of intangible assets and value drivers in R&D organizations. *R&D Manag.* **35**(2), 111–124 (2005)
23. Sudarsanam, S., Sorwar, G., Marr, B.: Real options and the impact of intellectual capital on corporate value. *J. Intellect. Cap.* **7**(3), 291–308 (2013)
24. Tam, L., Massingham, P.R.: The relationship between human capital, value creation and employee reward. *J. Intellect. Cap.* **16**(2), 390–418 (2015)
25. Tseng, C.-Y., Goo, Y.-J.J.: Intellectual capital and corporate value in an emerging economy: empirical study of Taiwanese manufacturers. *R&D Manag.* **35**(2), 187–201 (2005)
26. Jones, D.M.C.: Accounting for human assets. *Manag. Decis.* **11**(3), 183–194 (1973)
27. Sullivan, P.H.: *Value Driven Intellectual Capital: How to Convert Intangible Corporate Assets into Market Value*, 1st edn. Wiley, New York (2000)
28. Quinn, J.B., Anderson, P., Finkelstein, S.: Leveraging intellect. *Acad. Manag. Exec.* **10**(3), 7–27 (1996)

29. Roos, J., Roos, G., Dragonetti, N.C., Edvinsson L.: *Intellectual Capital: Navigating the New Business Landscape*, 1st edn. Palgrave Macmillan, Basingstoke (1997)
30. Stewart, T.A.: *Intellectual Capital: The New Wealth of Organizations*. Doubleday, New York (1997)
31. Brooking, A.: *Intellectual Capital*. Cengage Learning EMEA (1998)
32. Edvinsson, L., Malone, M.S.: *Intellectual Capital: Realizing Your Company's True Value by Finding Its Hidden brainpower*. HarperCollins, New York (1997)
33. Shakina, E., Barajas, A.: *The contribution of intellectual capital to value creation* (2013)
34. Dieter, C., Lüdenbach, N.: *IFRS Essentials*. Wiley, Hoboken (2013)
35. Kirk, R.: *IFRS: A Quick Reference Guide*. CIMA Publishing, Oxford (2008)
36. Bengtsson, M., Wallström, J.: *Accounting and disclosure of football player registrations: do they present a true and fair view of the financial statements? A study of Top European Football Clubs*. Ph.D. Thesis, Master's Thesis, Jönköping international business school, Jönköping university, (2014)
37. Schotté, M.: «Acheter» et «vendre» un joueur. *L'institution du transfert dans le football professionnel. Marche et organisations* **27**(3), 149–165 (2016)
38. Lhaopadchan, S.: *Fair value accounting and intangible assets: goodwill impairment and managerial choice*. *J. Fin. Reg. Compliance* **18**(2), 120–130 (2010)
39. Ciprian, G.G., Valentin, R., (Iancu) Mădălina, G.A., (Vlad) Lucia, V.M.: *From visible to hidden intangible assets*. *Procedia Soc. Behav. Sci.* **62**, 682–688 (2012)



Leadership Styles and Workplace Wellness Among Ghanaian SME Workers

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Abstract. This paper investigates the relationship between leadership styles and the quality of work life (QWL) among small and medium enterprises (SMEs) workers in Ghana. A cross-sectional design was used with standardized questionnaires to collect data. Both the simple random sampling and purposive sampling techniques were adopted to select respondents. A total sample of 200 respondents was engaged. The research findings suggest a positive relationship between QWL and transformational leadership style ($r = .63, p = .000$) with 'idealized influence' a dimension of transformational leadership significantly correlating with QWL. Transactional leadership style also had a positive relationship with QWL ($r = .53, p = .000$) although moderate. This suggests that in a developing country setting like Ghana, more exchange (give and take) form of relationships enhance employee quality of work life which is contrary to what pertains in other jurisdictions. Furthermore, males and females did not differ significantly on their QWL.

Keywords: Quality of Work Life (QWL) · Transformational leadership · Transactional leadership · Small and Medium Enterprises (SMEs) · Ghana

1 Introduction

Quality of work life is concerned with people's experience of satisfaction, motivation and commitment with regards to their work. It is based on the individual's perception. In other words the degree to which people are able to satisfy their personal needs while being employed is what depicts the workers' quality of work life. The consistent assessing of workers quality of work life provide vital feedback about the welfare and wellbeing of workers who are the life blood of organizations. It helps organizations to obtain cues about whether their workforce is healthy financially, socially and other aspects of the workers life. When a workers are dissatisfied with any part of their work, job or career, it can adversely affect their work performance regardless of their status and positions at the workplace. This could breed frustration, anger with self or others or boredom. These tend to have negative influence on individual's wellbeing as well as the progress of organizations. As much as humans are naturally insatiable, managers must do their best at all times to reduce job dissatisfaction and improve quality of work life at all organizational levels. Although this can be done, it is no secret that is a complex problem in view of the difficulty of isolating and identifying the attributes which affect in totality the quality of working life. For this reason management must

ensure that workers in organizations have at least a moderate level of satisfaction when it comes to their work life quality [1].

Leadership on the other hand is a complex construct that has pulled together lots of research from various disciplines. As a matter of fact, it remains an elusive concept with various perspectives which have not produced a definite definition for various scholars to agree on. This has resulted in different definitions and theories that explain the concept [2, 3]. This notwithstanding, leadership still remains an important concept that attracts numerous research investments from various disciplines [4, 5]. Leadership is said to have a very strong effect on attitudes of employees towards their jobs [5]. According to Mintzberg [6] good and effective leaders are those that engage others with consideration and modesty as they themselves engage in activities for the good of their organizations and not for their individual gains. A good and effective leader will be considerate with the plights of subordinates rather than just getting work done without considering the general wellbeing of subordinates.

1.1 Rationale and Purpose

According to Madhu and Kumar [7], employees are the lifeblood of every organization hence their comfort or discomfort largely determines their perception of good or bad quality of work life. The pattern of leadership employed in directing subordinates also have undeniable effects on certain work outcomes like job satisfaction [3], quality of work life [7] and other work outcomes and attitudes [5]. As the composition of workforce continues to change, companies focusing on quality of work life (QWL) of employees are expected to gain leverage in hiring and retaining valuable people. [7]. As a part of the broader quality movement in ensuring staff members' general wellbeing, quality of work life (QWL) has been recognised as an important facet in work place performance [7].

For this reason management in recent times ensure that workers in organizations have a moderate level of satisfaction and wellbeing when it comes to their work life quality [1]. Moving away from the very formal and corporate sector, the issue of quality of work life coupled with leadership especially in small and medium size enterprises will be an important area for leaders, managers and business owners to concentrate on, in order to retain good employees and attain their ultimate organisational goals.

2 Literature Review

Quality of Work Life Defined

Quality of work life is a very broad construct that covers a wide range of issues involving both financial and non-financial matters that relate to work context, contents and relations. Employees in the small and medium size enterprises form a large portion of human resources who contribute their services towards the realization of organizational goals. In addition, considering the tremendous contributions small and medium size enterprises offer to nation building, the quality of work life of employees of such

firms are of great importance that requires attention in achieving the goals of any sector of business. Quality of work life can be conceptualized as the quality of relationship between employees and the total working environment. It also has to do with concerns for human beings at work and is related to job satisfaction and organizational development [7]. Quality of work life propels employees' positive attitudes towards their work and organizations. It promotes productivity and motivation among workers and enhances organizations effectiveness and competitive advantage. Quality of work life as measured by [8] has seven dimensions of needs. These are: (i) health and safety needs; (ii) economic and family needs; (iii) social needs; (iv) esteem needs; (v) actualization needs; (vi) knowledge needs and (vii) aesthetics needs.

2.1 Leadership

Dartey-Baah [3] advances that in any social system, leadership is imperative for determining the path for the pursuit of goals or providing a guide to goal attainment. According to Porter-O'Grady [9] leadership is a multifaceted process of identifying a goal, being able to motivate people to act and providing needed support to achieve mutually negotiated goals. Cherry and Jacob [10] also define leadership as a person's attempt to influence the beliefs, opinions and behaviors of individuals or groups to follow a common course. In making people willing strive enthusiastically towards common goals and targets [11], there are often different styles adapted to achieving it. According to Giltinane [12], these are behavior patterns or could be termed as leadership styles used to lead followers. Though there are many theoretical approaches to the study of leadership styles [5], the most predominant which have received considerable research support is the transformational and transactional leadership by [13] as posited by Saleem [5]. The most recent one developed termed transformational leadership [3] which has been labeled by other scholars as resilient leadership, advocates for a combination of the qualities found in both the transformational and transactional leadership styles.

Transformational Leadership

Transformational leaders as the term suggests influence the values and needs to improve accomplishments of the followers. It is a leadership style geared towards changing the beliefs, values and attitudes of followers in order to align to the collective goals of an organization. These leaders do not rely on their legitimate power to get things done but rather take keen interest interacting, inspiring obedience, loyalty and trust among their subordinates [14] cited in [5, 15]. The concept is a component of the Bass and Avolio's full range leadership theory which has been extensively researched in the leadership field [16]. Transformational leadership is seen to be the ideal type of leadership that makes use of both individual and holistic strategies to meet a group's collective goal [3]. It upholds and encourages the unique contributions of individuals to the ultimate goals of organizations.

This type of leadership has four major elements: idealized influence, inspirational motivation, intellectual stimulation and individualized consideration [17]. *Idealized influence* constitutes the ability of leader to act as role model, willingness to take risks

and follow a set of core values, convictions and principles by the leader's actions. *Inspirational motivation* also is the ability to inspire confidence and a sense of purpose in followers. Here, the leader is expected to have a clear vision and communicate effectively and precisely with followers as well as show commitment to set goals. *Intellectual stimulation* also refers to how the leader involves followers in decision making by stimulating them to be creative and innovative in seeking solutions to problems. The leader challenges the followers to think 'outside the box'. *Individualized Consideration* is the ability of the leader to recognize and consider the individual needs and desires of followers; to know what motivates each individual and capitalize on it to obtain the best from each follower.

Transactional Leadership

Transactional leadership on the other hand is one that gives the follower rewards and benefits for obeying the leader and complying with the leader's requests [18]. This type of leadership is based on 'exchange' between the two parties [5]. With this type of leadership, the leader-follower exchange is based on rewards and punishments with the follower [19]. Goals or targets set are short-term and measurable [20], to allow for effective transactions. This makes such leaders more task and goals directed but are less people-conscious. These leaders allow team members to make their own decisions, avoiding interference from the leader. The leader only steps in when a problem arises. Thus, this leadership style does not move beyond the task versus reward relationship between leaders and followers [21]. This style of leadership is further divided into contingency reward and management by exception (active and passive) according to Bass [22]. When the hard work and good acts of followers are rewarded from time to time, it is termed contingent reward. Management by exception can be active or passive. With management by exception (active), leaders pay particular attention to followers and ensure that they comply with organizational laid down rules and procedures. Here, there is frequent interactions to monitor and offer assistance to employees if need be. Passive management by exception on the other hand offers subordinates freedom and 'breathing space' and the leader only intervenes when errors or total deviations spring up.

2.2 Transformational and Transactional Leadership vs. Quality of Work Life

According to Bass and Avolio [23] transformational and transactional leadership over some decades have been very popular in the leadership literature. Many studies have examined the positive relations between transformational leadership and motivation as well as group and organizational performance [24]. These positive effects are because transformational leaders build personal and social rapport with followers with the ultimate goal of the organization in mind. Transformational leaders also encourage members to work together thus boosting group performance. Kelloway and Barling [25] also examined and realized some positive effects of transformational leadership on some psychological indicators of QWL such as work satisfaction, psychological well-being and happiness. Nielson et al., [26] also showed in their study among health personnel who work within the elderly care sector of a Danish local government

department that there is a positive link between employees' psychological wellbeing and the transformational leadership style. This was also noted to have improved their perceptions of a meaningful work and career. Similarly, other studies have shown how transformational leadership predicts work satisfaction and wellbeing [27–29].

Furthermore, a survey conducted by Esra and Zeynel [30] which assessed the effect of employee motivation on improved quality of work life found that happy and productive employees always have a sense of belonging in the institution (a characteristic of transformational leadership). This sense of belonging, motivation and interaction increases the employee's productivity, institutional effectiveness and employee quality of work life. This is also the case because transformational leaders help subordinates to be productive, innovative and adaptable to different conditions [31] thereby avoiding work related problems [32]. Dartey-Baah and Ampofo [20] in their study on leadership and job satisfaction found positive associations between transactional leadership and job satisfaction. Similar studies have also seen significant associations of aspects of transactional leadership (contingent rewards) and job satisfaction [33–35] which is a key indicator of a person's quality of work life [7, 36].

2.3 Gender and Quality of Work Life

On the dimensions of gender on quality of work life, there have been mixed findings. Desselle [37] for example found no significant difference among males and females on quality of work life. On the other hand, quality of work life was found to be associated with rate of pay, age, job satisfaction and commitment but not with gender or ethnic backgrounds. Another study of Moen and Yu [36] on working couples work conditions and quality of work life, reported that work life quality is gendered. Using data on a sub-sample of workers in dual-earner families from the 1992 National Study of the Changing Workforce, it was found that quality of work life are same across gender, with conditions at work being a key predictor of life quality for both men and women. Additionally, women who found themselves in dual earner arrangements reported low quality of work life as compared to men. These women reported more stress and work overload as well as lower coping and mastery than men. The study showed that a demanding job and job insecurity are linked with low quality of work life. However, it was found that having a supportive supervisor who is tolerant (i.e. having transformational leadership qualities) is positively linked with quality of work life outcomes.

2.4 Hypotheses Statement

Hypothesis 1: *'there will be a positive significant relationship between employees' quality of work life and transformational leadership style.'*

Hypothesis 2: *'there is likely to be a significant negative relationship between employees' quality of work life and transactional leadership style.'*

Hypothesis 3: *'Among all the 4 dimensions of transformational leadership' idealised influence' is likely to contribute more variance in the quality of work life of employees.'*

Hypothesis 4: *'Females workers are more likely to enjoy high quality of life than male employees'.*

3 Methodology

Sampling and Procedure

Purposive sampling technique was used in the selection of respondents. The purposive sampling technique was adopted because only selected small and medium enterprises (SME's) in Accra were used for the study. Statistics from the Registrar General's Department suggests that 92% of companies registered are micro, small and medium enterprises [38]. As matter of fact, the Greater Accra Region of Ghana alone, has (30.4%) of its population engaged in wholesale and retail trade while (16.7%) are in manufacturing activities (Ghana District Repository, 2006). These are the most dominant types of SMEs in Ghana (Ghana District Repository, 2006) cited in Mabe [38]. Out of the accessible population of SME's in Accra, a sample size of 200 was estimated as appropriate using the mathematical equation developed by Krejcie and Morgan [39] for sample size determination. Strict ethical considerations like privacy, confidentiality, informed consent and voluntary participation were adhered to.

3.1 Measures

Employees' quality of work life (QWL) was measured with the 16 item Quality of Work Life Scale (QWLS) by [8]. The scale measures the extent to which the seven needs of employees are satisfied through resources, activities, and outcomes from their participation in the workplace, which constitute their QWL. The seven types of needs that constitute the scale are: (i) health and safety needs; (ii) economic and family needs; (iii) social needs; (iv) esteem needs; (v) actualization needs; (vi) knowledge needs and (vii) aesthetics needs. The respondents were asked to respond to each item by checking a 7-point scale ranging from "strongly disagree" (1) to "strongly agree" (7). Cronbach Alpha reliability coefficient of this scale has been calculated as 0.78 by [8]. The scale has been adapted to Turkish culture by Afsar [40]. In this study, the Cronbach Alpha reliability coefficient of the scale has been calculated as 0.88 [17]. Multifactor Leadership Questionnaire (MLQ) was used to assess transactional and transformational leadership style ($\alpha = .89$). MLQ is a 5 point likert scale that ranges from 1 (not at all) to 5 (frequently if not always). An example is 'my manager provides me with assistance in exchange for my efforts', 'my manager instills pride in me for being associated with him/her' ($\alpha = .89$).

3.2 Analysis

The hypotheses were tested using partial correlation and one-way ANOVA. Partial correlation was deemed best to control for the influence of demographic variables while testing the relationship between the main variables of interest. The one way ANOVA was used to analyze gender differences with regard to quality of work life of workers. Preliminary tests for normality were conducted to be sure the data was evenly distributed and normal. The skewness and kurtosis values were within -1 and $+1$; indicating a normal distribution of scores [41].

3.3 Results

Hypothesis 1: *there will be a positive significant relationship between employees' quality of work life and transformational leadership style.*

The result from Table 1 showed a positive significant association between quality of work life and transformational style of leadership ($r = .63, p < .000$). This gives an indication that a worker becoming satisfied with their work life is largely tied to leaders adopting more transformational style of leadership. This style of leadership as indicated in literature makes workers more committed and attached to the organization. It breeds motivation, creates a sense of belongingness and the higher motivation increases, the productivity of employees, institutional effectiveness and quality of working life [30].

Table 1. Summary of partial correlation results for transformational and transactional leadership on QWL of employees

Variables	r	df	p
Transactional leadership	.53	191	.000
Transformational leadership	.63	191	.000

Note: Dependent variable: Quality of work life.

Control variables: age, gender, educational level; $p < .00; n = 200$

Hypothesis 2: *there is likely to be a significant negative relationship between employees' quality of work life and transactional leadership style.*

The results from Table 1 rather showed a positive significant association between quality of work life and transactional style of leadership ($r = .53, p < .000$) which does not support the hypothesis. Contrary to predominant facts in the literature, transactional leadership style had a significant positive relationship with quality of work life. From Table 1 though the relationship was positive, it was moderate correlation ($r = .53$) as compared to that of transformational leadership and QWL ($r = .63$). It however could be explained that the Ghanaian work setting nurtures and encourages more exchange relationships which is tilted towards transactional leadership than transformational leadership. A developing country like Ghana where a large portion of workers are hardly satisfied with their jobs due to meager salaries and poor conditions of service will be more acclimatized to the 'give and take' form of relationship than any other form of relationships where they are assured of getting rewards for their inputs.

Hypothesis 3: *The idealized influence dimension of transformational leadership is likely to contribute more variance in the quality of work life of employees.*

From Table 2 the results show that the idealized influence dimension of transformational leadership predicts QWL more than inspirational motivation, intellectual stimulation and individualized consideration. Idealized influence constitutes the ability of leader to act as role model, willingness to take risks and follow a set of core values, convictions and principles by the leader's actions. This with time makes the employee

connected to the leader as well as the organization’s goals and aspirations which coupled with other factors boosts the QWL of workers.

Table 2. Summary results for the subscales of transformational and transactional leadership in predicting QWL

Leadership dimensions	B	Std error	Beta	t	Sig.
<i>Dimensions of transformational leadership</i>					
Idealized influence	1.86	.27	.51	6.3	.000
Inspirational motivation	.26	.45	.05	.58	.56
Intellectual stimulation	-.26	.38	-.05	-.69	.49
Individualized consideration	.78	.38	.14	2.04	.04
<i>Dimensions of transactional leadership</i>					
Active-MA	.88	.34	.19	2.59	.01
Passive-MP	-.06	.31	-.14	-.19	.05

Note: *Dependent variable: QWL*

Hypothesis 4: ‘Females workers are more likely to enjoy high quality of life than male employees’.

The results from Table 3 showed that though females scored higher than males on quality of work life, the difference observed were not significant. This implies men were equally satisfied with their work life as women and therefore quality of work life is not gendered. Its indicators may be other factors beyond being a male or female per se. These factors may be more work related than the sex of a worker.

Table 3. One-way Anova results for quality of work life for males and female workers

Variable		Mean	SD	n	F	p
QWL	Male	63.35	13.72	107	.54	.46
	Female	65.04	18.84	93		

Note: $p > .05$ QWL-quality of work life

4 Discussion

The findings of the study showed positive relationship between transformational leadership and quality of work life [25–29] as well as transactional leadership [20, 32, 34] and quality of work life. Furthermore, although the two leadership styles had significant positive relationship with quality of work life, the correlation between transactional leadership and quality of work life was moderate compared to transformational leadership which had a stronger relationship with quality of work life. This implies that though the relationship based on exchange of rewards and punishment has strong implications with workers’ quality of work life; even stronger is the implications transformational leadership has for quality of work life among workers in Ghanaian

SMEs. Considering the results obtained from the study and employees' individual differences, it will be prudent for managers and owners of SMEs to adopt the two types of leadership and blend them to boosting the quality of work life for employees. This style of leadership is what Dartey-Baah [3] terms *transfor-sactional leadership*. The study findings also showed that among all the four dimension of transformational leadership, it was idealized influence that predicted most quality of work life. This aspect of transformational leadership which constitutes the ability of leader to act as role model, willingness to take and share risks with followers and follow a set of core values, convictions and principles by the leader's actions [42]. It is marked by a display of high level of ethical and moral conduct which is not hypocritical. With leaders showing forth this kind of quality to their followers coupled with fulfilling their part of obligations in the leader- follower relationship, it is bound to translate into a better quality of work life. Subsequently, males and females did not differ significantly on quality of work life and this is in congruence with the studies of Desselle [37]. As indicated by Moen and Yu [36], the factors that indicate quality of work life are same for both men and women. A demanding job as well as job insecurity is linked with low quality of work life but having a supervisor who is supportive and tolerant is positively linked with quality of work life outcomes. This means the main issues managers and owners should concentrate on in their bid to improve workers' quality of work life is good work conditions as well as cordial and enabling relations with workers [36].

5 Conclusion

The study results have shown the important links the two major types of leadership styles (transformational and transactional) have with quality of work life. With the study results obtained for the relations transformational and transactional leadership styles have with quality of work life, it will be prudent for managers and owners of SMEs to blend both leadership styles strategically in boosting the quality of work life of their workers seeing that both had significant relations with quality of work life. The study results also showed quality of work life is not gendered but mostly based on work conditions and other work indicators rather than gender.

5.1 Implication for Practice

Leadership is a key factor known to propel success in organizations and has been related strongly to work satisfaction and commitment, job satisfaction and quality of work life in the literature. This presupposes that leadership styles must carefully be selected to boost workers quality of work life. Hence, discovering the attributes of successful leadership becomes very important. This coupled with a balance of the various leadership styles in dealing with employees can produce positive outcomes in the workplace. In order to ensure the wellbeing of workers and promote work effectiveness, leadership styles must not be overlooked because it can affect the overall impression workers have of their jobs.

5.2 Implication for Research

Quality of work life has various dimensions that make up the construct. For further understanding into how it relates with quality of work life, the various dimensions can be compared with leadership to assess the nature of their relations. This was not covered in the current study because quality of work life was measured as a composite construct. Again, job satisfaction, commitment, work attachment can be compared in future studies with quality of work life to know their exact relationship trends.

References

1. Dartey-Baah, K., Ampofo, E.: Missing link between quality of work life and productivity of loan disbursement: the Ghanaian perspective. *Int. J. Bus. Manag.* **11**(3), 203–214 (2016)
2. Cummings, G.G., MacGregor, T., Davey, M., Lee, H., Wong, C.A., Lo, E., Stafford, E.: Leadership styles and outcome patterns for the nursing workforce and work environment: a systematic review. *Int. J. Nurs. Stud.* **47**(3), 363–385 (2010)
3. Dartey-Baah, K.: Resilient leadership: a transformational-transactional leadership mix. *J. Glob. Responsib.* **6**(1), 99–112 (2015)
4. Chiok Foong Loke, J.: Leadership behaviours: effects on job satisfaction, productivity and organisational commitment. *J. Nurs. Manag.* **9**(4), 191–204 (2001)
5. Saleem, H.: The impact of leadership styles on job satisfaction and mediating role of perceived organisational politics. *Procedia Soc. Behav. Sci.* **172**, 563–569 (2015)
6. Mintzberg, H.: Developing leaders. *Dev. Ctries.* **1**(2), 414–425 (2010)
7. Madhu & Kumar Banking in India. *XIBA Bus. Rev.* **1**(1) (2015)
8. Sirgy, M.J., Efraty, D., Siegel, P., Lee, D.J.: A new measure of quality of work life (QWL) based on need satisfaction and spillover theories. *Soc. Indic. Res.* **55**(3), 241–302 (2001)
9. Porter-O'Grady, T.A.: Different age for leadership, part 1: new context, new content. *J. Nurs. Adm.* **33**(2), 105–110 (2003)
10. Cherry, B., Jacob, S.: *Contemporary Nursing: Issues, Trends, & Management*. Elsevier Health Sciences (2016)
11. Wehrich, H., Koontz, H.: *Management: A Global Perspective*. Tata McGraw-Hill, New Delhi (2005)
12. Giltinane, C.L.: Leadership styles and theories. *Nurs. Stand.* **27**(41), 35–39 (2013)
13. Bass, B.M., Avolio, B.J.: Transformational leadership: a response to critics. In: *Leadership Theory and Research: Perspectives and Directions*, pp. 49–80 (1993)
14. Northouse, P.G.: Transformational leadership. In: *Leadership: Theory and Practice*, 4th edn., pp. 175–206 (2007)
15. Yukl, G.: *Leadership in Organizations*. Prentice Hall, Upper Saddle River (2006, 2002)
16. Harms, P.D., Credé, M.: Emotional intelligence and transformational and transactional leadership: a meta-analysis. *J. Leadersh. Organ. Stud.* **17**(1), 5–17 (2010)
17. Ghanbari, S., Eskandari, A.: Transformational leadership, job satisfaction, and organisational innovation. *Int. J. Manag. Perspect.* **1**(4) (2014)
18. Bass, B.M.: From transactional to transformational leadership: learning to share the vision. *Organ. Dyn.* **18**(3), 19–31 (1990)

19. Naidu, J., Van der Walt, M.S.: An exploration of the relationship between leadership styles and the implementation of transformation interventions. *SA J. Hum. Resour. Manag.* **3**(2), 1–10 (2005)
20. Dartey-Baah, K., Ampofo, E.: “Carrot and stick” leadership style: can it predict employees’ job satisfaction in a contemporary business organisation? *Afr. J. Econ. Manag. Stud.* **7**(3), 328–345 (2016)
21. Dartey-Baah, K., Addo, S.A.: Leaders as organisational representatives: a structural model. *Afr. J. Econ. Manag. Stud.* (2018). <https://doi.org/10.1108/AJEMS-11-2017-0288>
22. Bass, B.M.: Does the transactional–transformational leadership paradigm transcend organisational and national boundaries? *Am. Psychol.* **52**(2), 130 (1997)
23. Bass, B.M.: The future of leadership in learning organizations. *J. Leadersh. Organ. Stud.* **7**(3), 18–40 (2000)
24. Judge, T.A., Piccolo, R.F.: Transformational and transactional leadership: a meta-analytic test of their relative validity. *J. Appl. Psychol.* **89**(5), 755 (2004)
25. Kelloway, E.K., Barling, J.: Leadership development as an intervention in occupational health psychology. *Work Stress* **24**(3), 260–279 (2010)
26. Nielsen, K., Randall, R., Yarker, J., Brenner, S.O.: The effects of transformational leadership on followers’ perceived work characteristics and psychological well-being: a longitudinal study. *Work Stress* **22**(1), 16–32 (2008)
27. Kelloway, K., Turner, N., Barling, J., Loughlin, C.: Transformational leadership and employee psychological well-being: the mediating role of employee trust in leadership. *Work Stress* **26**(1), 39–55 (2012)
28. Nielsen, K., Daniels, K.: Does shared and differentiated transformational leadership predict followers’ working conditions and well-being? *Leadersh. Q.* **23**(3), 383–397 (2012)
29. Tafvelin, S., Armelius, K., Westerberg, K.: Toward understanding the direct and indirect effects of transformational leadership on well-being: a longitudinal study. *J. Leadersh. Organ. Stud.* **18**(4), 480–492 (2011)
30. Esra, Z.: The effects of work motivation in quality of work life and a study on banking sector. Paper Presented at the 3rd International Symposium on Sustainable Development, Sarajevo, Bosnia and Herzegovina (2012)
31. Furkan, B., Kara, E., Tascan, E., Avsalli, H.: The Effects of leadership on job satisfaction (Visionary Leadership, Transformational leadership, Transactional leadership). In: 3rd International Symposium on Sustainable Development, pp. 220–226 (2010)
32. Berson, Y., Avolio, B.J.: Transformational leadership and the dissemination of organisational goals: a case study of a telecommunication firm. *Leadersh. Q.* **15**(5), 625–646 (2004)
33. Corsalini, N.N., Demissie, A.: Relationship between leadership styles of nurse managers and nurses’ job satisfaction in Jimma University Specialized Hospital. *Ethiop. J. Health Sci.* **23** (1), 49–58 (2012)
34. Dartey-Baah, K., Alesinya, A., Lamptey, A.: Leadership behaviors and organizational citizenship behavior: the mediating role of job involvement. *Int. J. Bus.* **24**(1), 74–95 (2019)
35. Voon, M.L., Lo, M.C., Ngui, K.S., Ayob, N.B.: The influence of leadership styles on employees’ job satisfaction in public sector organizations in Malaysia. *Int. J. Bus. Manag. Soc. Sci.* **2**(1), 24–32 (2011)
36. Moen, P., Yu, Y.: Effective work/life strategies: working couples, work conditions, gender, and life quality. *Soc. Probl.* **47**(3), 291–326 (2000). <https://doi.org/10.2307/3097233>
37. Desselle, S.P.: Snapshot of US certified pharmacy. 5 technicians: a nationwide quality of workforce study. *J. Am. Pharm. Assoc.* **45**(3), 458–465 (2005)
38. Mabe, F.N., Mabe, D.M., Sienso, G.: Empirical analysis of determinants of liquidity positions of SMEs in Greater Accra Region of Ghana. *Int. J. Bus. Manag. Tomorrow* **3**(11), 1–8 (2013)

39. Krejcie, R.V., Morgan, D.W.: Determining sample size for research activities. *Educ. Psychol. Measur.* **30**(3), 607–610 (1970)
40. Afsar, S.T.: Effect of quality of work life on organisational commitment level: the quantitative research on academicians in State and Foundation Universities. Unpublished Ph.D. thesis, Hacettepe University, Ankara, Turkey (2011)
41. Tabachnick, B.G., Fidell, L.S.: *Using Multivariate Statistics*, 3rd edn. Harper Collins, New York (1996)
42. Dartey-Baah, K.: Goal integration through transformational leadership: a panacea to Ghana's public sector corruption menace. *J. Glob. Responsib.* **7**(1), 4–25 (2016)



A Study of Team Structure to Enable Effective Product Development Process Implementation

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Abstract. C-company in aviation field is taking practical steps in introducing the lean product development (LeanPD) and system engineering practice. In order to have an effective implementation of PD approaches and resolve issues related to coordination, collaboration and communication, a new organizational structure related to the product development has been proposed for C-company. The analysis of the literature and field study help to formulate a conceptual model of product development team structure for avionics department in C-company. The proposed team structure and corresponding mechanisms in this paper not only could match the system V model applied in C-company, considering the different levels (system level, subsystem level) as well as the key essential, like requirement engineering, interface management, function analysis etc., but also considered the enablers of lean thinking application, like knowledge exchange and management, chief engineer, multi-discipline teams, etc.

Keywords: System engineering · LeanPD · Work Breakdown Structure · Team structure

1 Introduction

The paper describe a method used to develop a suitable product development team structure to enable effective implementation of lean thinking and system engineering in avionics department in C-company.

C-company is an aircraft design and development company in China. It began to introduce system engineering approach (system V model) and lean thinking into their PD process since 2013. However, the mismatch between organizational structure and PD process made C-company struggling with several issues. Therefore, there is a need to adapt their organizational structure to effectively implement lean thinking as well as match ‘system V model’.

2 Literature Review

2.1 Practices of Organizational Structure

The practices of organizational structure were explored through literature review. Three typical ones were introduced below.

Blanchard [1] introduced a matrix organizational structure considering application of system engineering. Morgan and Liker [2] introduced Toyota's vehicle development centres structure which was a relatively detailed one considering both company level and department level. Sheard and Margolis [3] proposed a product development team structure which was used for product development using integrated product teams. All the practices mentioned above, as well as others in the literature, could not be applied directly to achieve the aim for C company. Neither of them justified how the organizational structure could enable effective product development process. However, each of the practices could provide lessons for the design of a new organizational structure.

2.2 Product Development Team Structure Design Approach and Principles

A generic approach to redesign a product development team structure could be summarized as three steps [4–6]:

Step 1. Analyse the current team structure and find the potential gaps to be improved.

Step 2. Decompose the total scope of product development work into smaller related activities in terms of specialization and responsibilities and find out the inter-relationships between activities.

Step 3. Define a new team structure that covers the activities analyzed in step 2, meanwhile, build reporting relationship as well as corresponding administrative mechanisms to fill the gaps.

Moreover, the related methods to apply the approach above were explored. In terms of step 2, semi-structured interview was a useful tool to study current situation of the targeted organization.

Regarding step 2, several researches especially in system engineering and project management field used Work Breakdown Structure (WBS) to decompose the total work [7, 8].

Concerning step 3 for defining a new team structure, several principles should be followed [1, 4, 9]:

1. The team structure should match the product architecture.
2. The team structure should minimize the interdependencies across teams.
3. The team structure should maximize the resource utilization.
4. There should be a communication channel which would enable knowledge development and sharing.
5. There should be a management mechanism to handle interdependency and conflicts between teams.

3 Proposal of Product Development Team Structure

A systematic approach which is shown in Fig. 1 was used to reorganize the product development team structure for avionics department in C-company to enable effective implementation of system engineering and LeanPD. The following sections would present the details step by step.

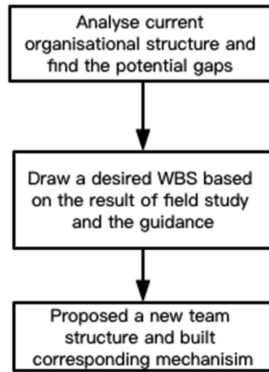


Fig. 1. An approach to reorganise a team structure

3.1 Analysis of Current Practices of Team Structure in C-company

To analyse current practices of team structure for Avionics department in C-company, semi-structured interview was conducted. Five representative interviewees from C-company were chosen to participate in the interview. The challenges related to product development team structure and its corresponding mechanisms that affect the effective implementation of LeanPD and system engineering were highlighted as follows:

1. Lack of a well-defined WBS to organize overall work and define deliverable.
2. Poor communication and transfer of requirements between teams in different level or even in the same level.
3. Each team takes too much responsibilities which led to low work efficiency and poor deliverable.
4. There is no hierarchy for team structure. The span of control for the chief engineer for avionics system was too big which led to late decision-making.
5. Unreasonable human resource allocation which results in overload of key personnel and misallocation of key tasks.
6. Lack of a mechanism that could identify and freeze the interface in an early stage and deal with interdependencies between teams especially crossing department.
7. Lack of effective knowledge management team and award mechanism.

3.2 Develop a WBS Based on the Principles of System Engineering and LeanPD

Considering the relationship between organizational structure and WBS [10], the starting point to build a product development team structure is to decompose the total work into manageable work packages. A WBS was developed based on the characteristics of V model applied in C company.

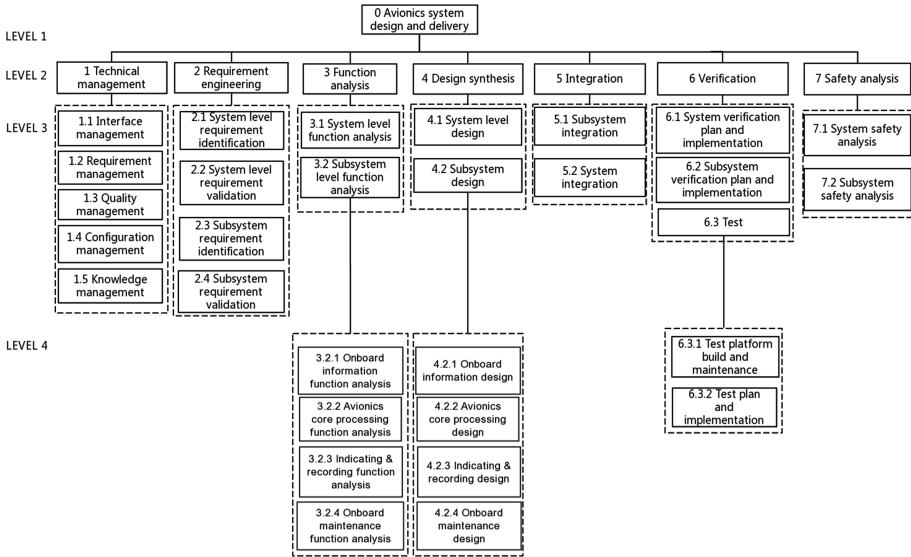


Fig. 2. A proposed WBS for avionics system in C-company

Following the guidance for the development of WBS [11], a four-level WBS with all the elements being numbered was illustrated in Fig. 2:

1. Level 1. Identify the scope of total work as development of avionics system design and delivery.
2. Level 2. In this level, main tasks defined by system V model were listed. There were two categories of tasks, technical task and technical management task. Since technical task is more complex and each task could be decomposed to several subtasks, they were listed individually in this level.
3. Level 3. In this level, subtasks that are subordinate to task 2 to 7 in level 2 are identified. Most of subtasks listed in level 3 could be assigned to individuals or teams except for subsystem function analysis and design. Since those two subtasks are expertise related and could be very complicated, they should be decomposed to lower level and allocated to different expertise teams.
4. Level 4. Activities listed in this level were derived from level 3 and could not be decomposed to more details.

3.3 Propose a Team Structure for Avionics System Development

To better implement system engineering as well as LeanPD, it is critical to propose a new product development team structure with assigning the right personnel in a timely manner.

There are three tasks needed to be done when putting forward the proposal:

1. Build a team structure corresponding to WBS.
2. Allocate appropriate personnel to each team.
3. Develop the corresponding mechanisms to make the structure more effective.

A Product Development Team Structure Corresponding to WBS. A three-level team structure shown in Fig. 3 was proposed according to WBS shown in Fig. 2. And the responsibilities which are lowest-level activities defined in the proposed WBS were assigned to the corresponding teams. In this structure, chief engineer and cross-functional integrated product teams were applied to enable LeanPD implementation.

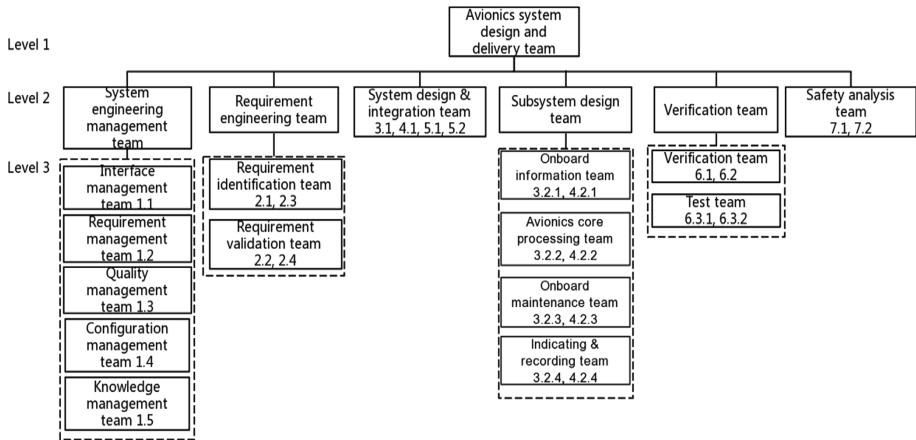


Fig. 3. A proposed product development team structure for avionics department

The development process of the team structure is bottom-up. The first step was to build the teams that are responsible for the lowest level activities of the WBS. 15 teams were built in level 3. The criteria to group activities and build corresponding teams were based on the principles summarized in the literature review as well as the prevention of issues highlighted in Sect. 3.1. For example, system design task and integration task are executed in both concept phase and implementation & verification phase respectively.

The next step was to categorize the 15 teams and make up level 2 team structure. Considering similarity and tightness of activities, 6 teams were built to led level 3 teams. Also, 6 senior managers were assigned and empowered. This hierarchical structure resolves the challenge 4 mentioned in Sect. 3.1.

Level 1 is avionics system design and delivery team which is led by a deputy chief engineer.

Considering project management as well as technical performance, each team has a project manager and a chief engineer [12]. The project manager belonging to project management function department is responsible for time and cost considerations, whereas the chief engineer who comes from avionics department is concerned with technical activities and decisions. The application of chief engineer is one of the key enablers for LeanPD implementation.

Allocate Appropriate Personnel to Teams. This step was aimed to resolve challenge 5 mentioned in Sect. 3.1. After discussing with the interviewees, the following human resource allocation were defined.

A few key representatives with appropriate skills and experience from different functional teams should be selected to compose cross-functional teams (requirement engineering team and system design & integration team). Requirement engineering team should comprise individuals with the knowledge of requirement engineering as well as solid professional knowledge of the whole avionics system. Personnel allocated to system design team should be experienced with avionics system design and understand the subsystems very well. People who are engaged in system design are the best choices to do system integration since they are familiar with the whole architecture.

As for subsystem design, each team is functionally specialized and do most of their work independently, thus, no cross-disciplinary representative is needed. This kind of team could be grouped by senior and junior engineers with the special knowledge.

Verification is another important task for system engineering. Although verification is implemented in the final stage of PD process, it should be planned from preliminary design stage. The verification team was built since then. Personnel allocated to verification team should have a background of avionics system and a strong knowledge of system engineering.

Test is an important methodology to implement verification and validation. People who were allocated to test team should have the knowledge of modelling and simulation, programming and electronics system test.

Develop Corresponding Mechanism. Once the team structure has been built and personnel have been assigned, the next step is to build corresponding mechanisms.

Mechanism 1. Handle interdependencies between teams crossing departments. A team leads team was introduced to the lowest level of the team structure to resolve this problem [3]. Representatives chosen from each system development team (avionics system, power plant system, etc.) meet with each other regularly. The commitment of this team is served as a liaison to coordinate the suppliers' and customers' schedule plans to be consistent, resolve the interface technical problems, identify problems in the early stage as well as develop methods and tools for problem settlement.

Mechanism 2. Build knowledge exchange mechanism. As mentioned before, knowledge share meetings could not promote knowledge share between programmes. An expert team was recommended to solve this problem. This could be organized as an ad hoc IPT in which team members are core members from other programmes to review the design in each milestone.

4 Discussion

Comparing to the current product development team structure, the proposal resolved all the challenges, and in the meantime, considered the principles and essentials of LeanPD and system engineering:

1. Build a thorough and reasonable WBS considering the detailed activities derived from system V model and lean principles as well as the relationship between tasks.
2. The new team structure has three levels and the senior managers in level 2 were empowered to make decisions within their teams. This hierarchical structure releases the deputy chief engineer's pressure and facilitate the decision-making efficiency.

3. There are 15 teams in the lowest level replacing the 6 teams of the existing team structure, which makes the responsibilities of each team clearer and enables the teams to focus on the development of their own expertise.
4. The requirement identification, validation and verification are allocated to different teams, which lays the foundation of the product design and ensures the transfer and understanding of the requirement.
5. The interdependencies management mechanism resolves the interface management problems and the poor communication crossing teams/departments.
6. Allocating personnel with appropriate qualifications and experience to different teams according to different levels of design and different stages of PD lifecycle rationalize the human resource allocation and could release the overload of core engineers.
7. The chief engineer, knowledge management team, multidisciplinary integrated product teams as well as the knowledge exchange mechanism are all enablers of LeanPD.

Apart from the advantages above, there are some limitations to be discussed:

1. The proposal presented in this thesis needs further validation by a pilot project to justify the principles applied.
2. The proposal did not consider more details like the number of team members and the responsibilities of each member.

Proposing an organizational structure is just the first step. A further challenge is how to implement it into the current PD process in C-company.

References

1. Blanchard, B.S.: System Engineering Management. Wiley, Hoboken (2008)
2. Morgan, J.M., Liker, J.K.: The Toyota product development system. *Machine Design* (2006)
3. Sheard, S.: Team structures for systems engineering in an IPT environment. In: Proceedings of INCOSE (1995)
4. Sosa, M.E., Eppinger, S.D., Rowles, C.M.: The misalignment of product architecture and organizational structure in complex product development. *Manag. Sci.* **50**(12), 1674–1689 (2004)
5. Gokpınar, B., Hopp, W.J., Iravani, S.M.R.: The impact of misalignment of organizational structure and product architecture on quality in complex product development. *Manag. Sci.* **56**(3), 468–484 (2010)
6. Luna, R.R., Eppinger, S.D.: Structuring a product development organization based on the product architecture and communication. In: 17th International Dependency and Structure Modeling Conference, DSM 2015, pp. 31–39 (2015)
7. Brotherton, S.A., Fried, R.T., Norman, E.S.: Applying the work breakdown structure to the project management lifecycle. In: PMI Global Congress Proceedings, pp. 1–15 (2008)
8. MIL-STD-881D, Standard Practice Work Breakdown Structures (2018)
9. Burton, R.M., Obel, B., Døjbak, D.: How to get the matrix organization to work. *J. Organ. Des.* **4**(3), 37–45 (2015)

10. Altfeld, H.-H.: *Commercial Aircraft Projects: Managing the Development of Highly Complex Products*. Ashgate, Farnham (2010)
11. Project Management Institute: *Practice standard for work breakdown structures*. Project Management Institute (2006)
12. Kerzner, H.: *Project Management: A Systems Approach to Planning, Scheduling, and Controlling*. Wiley, Hoboken (2009)

Organizational Complexity and Leadership Management



Changes in the Organizational Culture of the University in Mergers and Acquisitions

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Abstract. Mergers and acquisitions of public universities are an issue that is completely in line with the spirit of new public management. The transfer and adaptation of M&A concepts and methods to public activities arise from the logic of the new public management approach. The cultures of public universities in merger processes should go through the process of amalgamation, but real integration or even hybridization of culture usually requires more time than the management aspects of consolidation. A good illustration of these are European universities: Aalto University, Linnaeus University, Université Grenoble Alpes. The aim of this article is to identify the key changes in the organizational culture of the university in mergers and acquisitions. The article discusses the complexity of the organizational culture of the university in the consolidation process. The research methodology was based on qualitative research - case studies of universities in Europe.

Keywords: University mergers · Organizational culture · University management · Mergers and acquisitions · Higher education sector

1 Introduction

Organizational culture in the university merger processes is a very important issue, it defines organizational values and identity, leads to the transformation of academic cultures, organizational communication and shaping the impact of the cultural context on the university. A frequent reason for the merger failure is underestimation of the so-called soft management areas related to culture and organizational identity [1].

Organizational culture in the case of a university is the core of its continuity and activity. This is due to the relative “longevity” of universities, the strong ethos nature of universities and academic work, and the cultural conservatism of academic institutions [2]. Universities, especially the prestigious ones, are usually long-term organizations the “DNA” of which includes: work for science, culture and the environment. The mission of the Humboldt-type university also developed the ethos of scientific skepticism, social criticism and academic independence. In recent decades, a profound change has been taking place in the cultural formation of universities, which is probably heading towards

an entrepreneurial and post-academic university [3]. However, the conservatism of academic culture initiates forms of resistance against the development of neoliberal organizational forms based on “new public management”. The sources of this resistance lie in rooted organizational values, according to which a prestigious university should last, not compete [4]. This conservative academic culture is strongly linked with academic identity and ethos, based on the values of free profession, criticism, autonomy, communitarianism and participation. The pressure exerted to move away from this backbone of traditional academic culture faces organizational resistance, university guilds and even students [5].

The consolidation of universities, which are complex and dynamic organizational processes, often lead to the growth of the management culture [6]. University leaders, managers and employees learn new management concepts, methods and techniques in practice. They adapt and test organizational solutions from other universities and business sectors. The introduction of merger is also often accompanied by the restructuring and implementation of new management methods. This fills a gap in the education of managers in universities, in which the division into the scientific-didactic and administration staff has been consolidated. The scientific and didactic staff, even if they hold managerial positions, rarely participate in the programs improving managerial competences. Mergers lead universities to implement ideas and organizational methods, contributing to the improvement of management culture.

2 Cultural Integration of Universities

Cultural integration during university mergers can take many forms. The weakest form that can occur in the case of federational mergers is the division of cultures when they are separated, as they develop towards subcultures or countercultures. This form of non-integration of cultures induces disintegration tendencies throughout the consolidation. An alternative form of lack of cultural integration is isolation, when, during the merger, university cultures remain separate subcultures and we are not dealing with their combination. The merging of cultures through the combination of selected configurations of organizational identity into the whole is called hybridization. Most often it takes a dynamic form, because, under the influence of the merger, the culture is transformed towards the convergence of values, norms and patterns. Amalgamation is an example of mixing up cultures and creating a relatively consistent configuration. Cultural unification is usually the effect of effective identity formation in management processes. Assimilation and full cultural integration are, in turn, often the result of taking over the patterns of a more prestigious university by the consolidated university. Acceptance is a formal adoption of systems of values, standards and patterns by employees, it may be accompanied by the emergence of subcultural processes (Fig. 1).

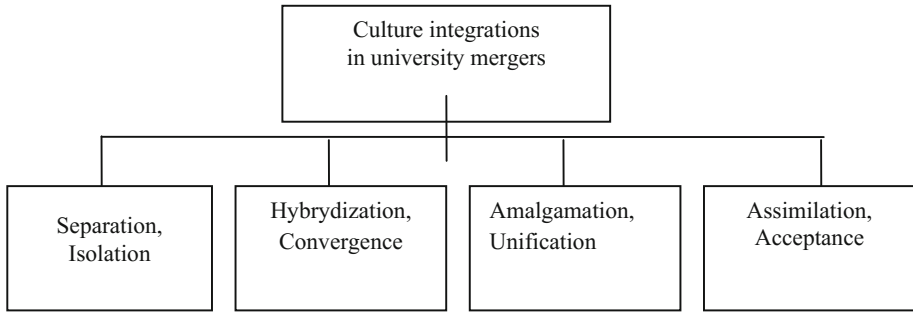


Fig. 1. Types of culture integrations in university mergers. Source: author's elaboration.

3 Cultural Integration Practice

In the practice of cultural integration in consolidation processes, several pragmatic principles developed in business mergers can be pointed out.

The first is to adapt the strategy to culture. It happens that the organization's strategy is imposed from above and does not translate into practice as well as values and norms resulting from the organizational culture. Changes in culture should be made carefully, with awareness of what they should lead to, but at the same time with openness and flexibility allowing for the transformation. Usually, an evolutionary approach to change is also more effective, which assumes that one should not completely deviate from the dominant value configuration.

Another principle is finding the strongest sides of existing cultures. It is beneficial to see the advantages of current cultures and preserve them, because thanks to this the stakeholders will oppose the changes to a lesser degree. Leaving some frameworks of the pre-merger university culture should foster greater identification of stakeholders with the ongoing transformation.

The third pragmatic rule is the integration of initiatives. Not only formal tools (procedures, incentive systems, performance indicators) should be used to promote values and new standards and to show their impact on the operation of an organization. It is very important to take care of the informal, emotional sphere of the organization, which is the network of contacts, communities of interest, shaped by spontaneous interactions, conversations, etc. Official and unofficial initiatives should also reach the emotional level of employees. This is a special task for leaders and change agents who influence the behavior of their subordinates and should work on suppressing undesired side effects and rewarding the right ones.

There are two groups of mechanisms - formal and informal ones - that allow to benefit from the organization's culture. The formal mechanisms include: processes, rules, training, decision-making powers, structure of reporting, development of both leaders and the entire organization, as well as wages and rewards. Informal mechanisms are: internal contact networks, good contact between managers and subordinates, changes in infrastructure, resources or décor (artifacts), shaping behavior by leaders, engaging the best employees to motivate others.

The fourth principle is to observe the evolution of culture. In the next stages, one should carefully look at its modifications and shape it in the desired direction. The observation of culture will ensure the maintenance of change dynamics in the strategic perspective [7].

4 Levels of Merger Research from a Cultural Perspective

The problems of the university's cultural change in the merger process can be analyzed on several complementary cognitive levels:

- Mergers of universities are a clash of cultures that evokes a reaction in the form of changing the organizational culture in many different forms, from: unification, assimilation through amalgamation and hybridization, creation of subcultures, to isolation and cultural conflict [8]. Models, types and components of organizational cultures of the universities allow to understand and manage the process of the university merger, taking into account the impact of values and norms.
- In the consolidation processes, the impact of the cultural context, and thus the value of the culture of the society in which the radical change takes place is also important. Depending on the configuration of the culture, values may favor or inhibit such changes [9].
- Consolidation is also reflected in changes in identity, both at the organizational and individual level. The answer to the questions: who are we as a university and who I am as a stakeholder of this university is changing in the merger processes. The question arises of constructing the identity and sense of collective mergers (sensemaking) that lead to the success of the venture and do not fall into conflict with academic values [10].
- Academic culture, also understood as a kind of ethos of a professional group of researchers and teachers, constitutes a significant context of changes taking place during the consolidation. Transformations of academic cultures in recent decades also have a significant impact on the course of consolidation processes in universities.
- In public university merger processes, the specificity of public organization cultures is revealed, which is differs such universities from private organizations [11].
- The consolidation of universities also requires a process of managing cultural change, which should increase the probability of a successful merger by strengthening the integration and constructive tendencies and eliminating destructive centrifugal tendencies [12].

5 Models of Culture in M&A

Classic models of organizational culture

The literature on the subject points to a large number of models, which very often served to construct the typology and were tested using empirical research. The most important – canonical - models of culture include the concepts of: E. Schein, G. Hofstede [13, 14]. E. Schein emphasizes that the organizational culture exists in part to answer two types of problems that concern any organization: problems related to adaptation to the organization's environment and problems related to internal

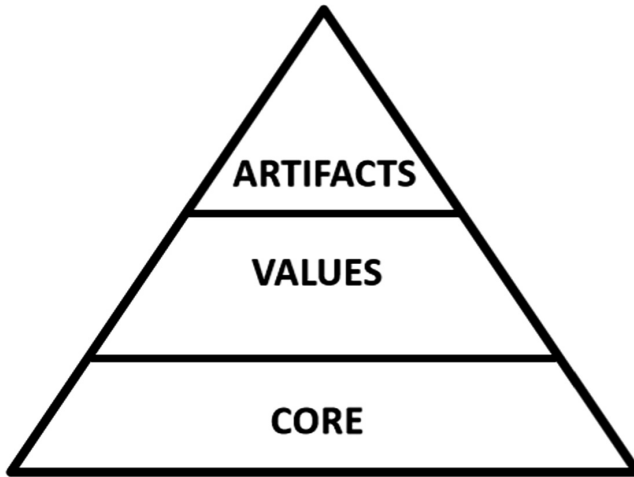


Fig. 2. The organizational culture model according to E. Schein. Source: [16].

integration [15, 16]. When modifying the pyramid model, one can symbolically represent the university merger process (Fig. 2).

The artifacts can include: logo, the appearance and decoration of buildings, dress code, signs of status, common expressions and abbreviations, jargon, slogans, myths, legends, ceremonies, rituals. Norms and values can be divided into those that are declared (it is declared what is good for the organization, what is praiseworthy, what is bad and reprehensible) and the ones that are observed (which we can recognize on the basis of various informal conversations and behaviors). The foundation and core of the organizational culture are assumptions, i.e. collections of basic patterns of orientation and imagination as well as philosophical and ideological assumptions, guiding perception and action.

G. Hofstede proposed a model of organizational culture that hierarchically organizes the elements of culture, metaphorically equating them to the layers of an onion (Fig. 3).

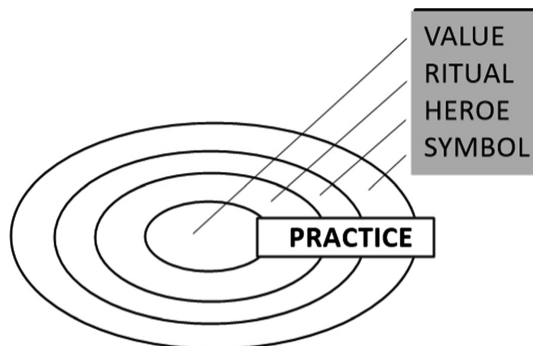


Fig. 3. “Onion diagram” by G. Hofstede. Source: [14]

Values are the core of the onion, the rituals and heroes form the intermediate layers, and the symbols are the most visible layer of the model. The last three components of culture are combined into a wider category of practices. Symbols are words, gestures, objects, images that are recognized by members of a given culture. Heroes are people who identified with the most-valued features in a given culture. They become role models. Rituals are repeating activities that express and emphasize the basic values of the organization. They can be seen in gestures, ways of greeting, religious and social ceremonies. Symbols, heroes and rituals make up practices that are legible only for members of a given culture. Values are, in turn, an image of what is important in a given environment and a given community. They are often referred to as the moral code. They indicate what should be - in contrast to what is. The accepted system of values leads to organizational culture norms that specify what is allowed and what is prohibited. Norms define the types of behaviors we can expect from members of a given organizational culture (Tables 1 and 2).

Table 1. Results of the research

Merger areas	Indicators	Jagiellonian University (UJ)	Medical University (UM)	Universite Grenoble Alpes (UGA)
Stakeholders' opinion of the merger	Before the merger	“Positive opinions prevailed at all, the more so that the soft merger option went through” (K1)	“Rather negative, in particular from WAM employees, but there were opponents of the merger also among UM professors” (L3)	“In most opinions cautious, but positive, students did not have a special opinion” (G1)
	During the merger	“Positive opinions prevailed at all, the more so that the soft merger option went through” (K1)	“As the scandals with the rector and the commissioner appeared, the opinion was even more negative, but there was no going back” (L3)	“Positive identification it was built on antagonism between the universities of Grenoble that joined the merger and the university that did not decide to do so” (G1)
	After the merger	“Undoubtedly this unification has brought the scientific benefits for both universities” (K1) “UJ gained a lot, and at the same time it was historical justice” (...)	“It is almost 15 years after the merger, and all the time there are voices that it was a mistake and the division into former employees of WAM and UM continues” (L3)	“Opinions among the staff and administration are rather positive, and the name and identification for students is simpler” (G1)

(continued)

Table 1. (continued)

Merger areas	Indicators	Jagiellonian University (UJ)	Medical University (UM)	Universite Grenoble Alpes (UGA)
University culture and identity	Organizational culture	“The reunification of the Jagiellonian University is partial, because CM has its own: vice-chancellor, chancellor, rector’s representatives, who are actually the counterparts of the vice-rectors in the Jagiellonian University” (K1)	“The military staff have different values [...] it’s hard to say that this is one culture” (L3)	“... we speak to those from the Polytechnic, and you see, you wanted to ... it’s so many years of getting used to integration, there are no strong antagonisms ... rather tensions between departments ... social sciences have lost ...” (G1)
	Cultural context of the merger	“A very conducive unification of the regional culture of Cracow” (K1) “some internal limitations in the sphere of different values” (K1)	“I do not know, in Łódź it was rather the opinion that two medical universities in the city is a waste of money” (L3)	“Very favorable atmosphere, the prefecture and ministry took part in it ... in general, most of the employees were in favor” (G1)
	Sensemaking	“Restoring the unity of the Jagiellonian University” (K1)	“An image was created outside and for employees of one strong medical school” (L3) “The second university in Łódź, that was something” (L1)	“des Alpes was developed in cooperation with advisers, it was supposed to cover more universities, but they dropped out”

Source: author’s elaboration.

Table 2. Results of the research

Merger areas	Indicators	Jagiellonian University	Medical University (UM)	Universite Grenoble Alpes (UGA)
Stakeholders' opinion of the merger	Before the merger	Positive on both sides	Many critical voices, treated as an "enforced" merger	1. Staff: ambivalent opinions 2. Administration: concern 3. Students: weak participation
	During the merger	Positive on both sides	Many critical voices, treated as an "enforced" merger	1. Training programs 2. Improvement of satisfaction
	After the merger	Positive on both sides	Many critical voices, treated as an "enforced" merger	1. Generally positive opinions of the staff, students and administration
University culture and identity	Organizational culture	Departmental subcultures, CM subculture	Departmental subcultures, with the strongest military-medical department	1. The strengthening of the new identity is progressing 2. It is also based on the separation from the university that did not join the merger
	Cultural context of the merger	The regional environment was very much in favor of the merger	The regional environment was fairly in favor of the merger	The environment was very much in favor of the merger (employers, public opinion, regional authorities)
	Sensemaking	Unification of the university	Rationalization of education - one medical school in the city	Grenoble - a world-class university
Merger effects	Managerial – culture and HR management	Departmental subcultures and CM subculture	Subculture of the military-medical department and others	Rather positive, new organizational identity
	Cooperation with the environment	The merger indirectly favors cooperation with the environment	The merger without much impact on the cooperation with the environment	Very much emphasis on cooperation with employers
	Ranking-related	Positive influence	Slightly positive	Slightly positive

Source: author's elaboration.

6 Conclusion

The cultures of public universities in merger processes should go through the process of amalgamation, but real integration or even hybridization of culture usually requires more time than the managerial aspects of the consolidation. It seems rational to stimulate cultural processes and leave time for the integration process, without exerting excessive pressure through aggressive propaganda and identity actions. Numerous, interesting, positive examples of constructing a new cultural identity in the merger process can be found all over the world. European universities are a good illustration of this: Aalto University, Linnaeus University, Université Grenoble Alpes [17]. However, even in the case of the flagship successful merger, i.e. the Finnish Aalto University, it took several years for the new culture to take root, and the process of constructing meanings (sensemaking) was not free from controversy [18].

When analyzing the public sector, an analysis must be made on the grounds of “new public management” [19]. Models of business activities, also referring to culture, are transferred to public activity, which is often criticized [20–22]. J.E. Lane points to examples of the successful introduction of new public management in different countries, also highlighting the role of the cultural context and institutions [23]. Ch. Hood attempts to synthesize the importance of new public management and emphasizes the conflict of values between the desire for both “efficiency” and “equality” in public management. The solution could be an “endless reprogrammability” of the new public management trend, enabling balancing between these values [24].

Mergers and acquisitions of public universities are an issue that is completely in line with the spirit of new public management. The transfer and adaptation of M&A concepts and methods to public activities arise from the logic of the new public management approach. Thanks to the application of an effective business-provenience approach, it is possible on the one hand to achieve a higher efficiency of operation. and on the other hand - consolidations of universities are also strongly connected with the concepts of public value governance, because they are the implementation of public policies, require central coordination and are implemented in the stakeholder model.

Joining organizational cultures is a difficult process that only partially undergoes managerial control. The premise for the success of a cultural merger is to conduct an analysis that takes into account organizational identity, status and prestige. The social identity approach indicates that university employees who gain prestige on the university’s merger will find it easier to accept the merger and will strive to connect on partner terms. The staff of the greater prestige and stronger culture university will probably be more skeptical about the consolidation and it will be more often perceived as the incorporation process of a less prestigious university [25]. The analysis of potential tensions and knowledge about the possibilities of solving them in the processes of communication and negotiation allows to manage the merger more effectively.

It seems, therefore, that it is worthwhile to undertake a multi-paradigmatic analysis of organizational culture in the consolidation processes of universities. Such a perspective may use a model based on the division into functionalist, interpretative and critical paradigms in the study of changes in organizational culture [26]. Functionalist paradigm is an attempt to look at the process of shaping the organizational culture of

the newly created university, which will be a derivative of the value systems of the merging organizations and will additionally bring about a synergy effect. Extracting the best cultural values, norms, models and practices from each organization and combining them into a new whole would be an ideal solution, although it may be a utopian task.

References

1. Seliga, R., Sulkowski, Ł., Woźniak, A.: Barriers to university mergers - comparative analysis of universities in Europe. In: *Advances in Human Factors, Business Management and Society Proceedings of the AHFE 2018 International Conference on Human Factors, Business Management and Society*, vol. 783, pp. 558–567 (2018). Springer
2. Sulkowski, Ł., Dzimińska, M., Fijałkowska, J.: Trust-based quality culture conceptual model for higher education institutions. *Sustainability* **10**(8) (2599), 2–22 (2018). Multidisciplinary Digital Publishing Institute
3. Sulkowski, Ł.: *Kultura akademicka. Koniec utopii?* PWN, Warszawa (2016)
4. Giroux, H.A.: Public intellectuals against the neoliberal university. In: Denzin, N.K., Giardina, M.D. (eds.) *Qualitative Inquiry; Past, Present, and Future: A Critical Reader*, pp. 194–223. Routledge (2015)
5. Naidoo, R., Williams, J.: The neoliberal regime in English higher education: charters, consumers and the erosion of the public good. *Crit. Al Stud. Educ.* **56**(2), 208–223 (2015)
6. Leslie, H.: *Joining Forces: The Case of Alliant International University*. Alliant International University (2013)
7. Austen, A.: Narzędzia kierowania zmianą kultury w organizacjach świadczących usługi społeczne. In: Frączkiewicz-Wronka, A., Marzec, I. (eds.) *Kultura organizacji publicznych świadczących usługi społeczne: orientacja, uwarunkowania i efekty*. Wydawnictwo Uniwersytetu Ekonomicznego, Katowicach (2015)
8. Vartiainen, P.: Campus-based tensions in the structural development of a newly merged university: the case of the University of Eastern Finland. *Tert. Educ. Manag.* **23**(1), 53–68 (2017)
9. Rottig, D., Reus, T.H., Tarba, S.Y.: The impact of culture on mergers and acquisitions: a third of a century of research. In: *Advances in Mergers and Acquisitions*, pp. 135–172. Emerald Group Publishing Limited (2014)
10. Ylijoki, O.H., Ursin, J.: The construction of academic identity in the changes of Finnish higher education. *Stud. High. Educ.* **38**(8), 1135–1149 (2013)
11. Pinheiro, R., Aarrevaara, T., Berg, E., Geschwind, L.: Strategic mergers in the public sector: comparing universities and hospitals. In: Tarba, S., Cooper, R., Sarala, C. (eds.) *Mergers and Acquisitions in Practice*. Routledge, London (2015)
12. Välimaa, J., Aittola, H., Ursin, J.: University mergers in Finland: mediating global competition. *New Dir. High. Educ.* **168**, 41–53 (2014)
13. Schein, E.H.: *Organizational Culture and Leadership. A Dynamic View*. Jossey-Bass, San Francisco, London (1986)
14. Hofstede, G., Hofstede, G.J., Minkov, M.: *Cultures and Organizations: Software of the Mind*. McGraw Hill Professional (2010)
15. Schein, E.H.: The role of the founder in creating organizational culture. *Organ. Dyn.* **12**(1), pp. 13–28 (1983)
16. Schein, E.H.: *Organizational Culture and Leadership*. John Wiley & Sons (2004)

17. Geschwind, L., Melin, G., Wedlin, L.: Mergers as opportunities for branding: the making of the Linnaeus University. In: Pinheiro, R., Geschwind, L., Aarrevaara, T. (eds.) *Mergers in Higher Education. The Experience from Northern Europe*, pp. 129–143. Springer International Publishing (2016)
18. Aula, H.M., Tienari, J.: Becoming “world-class”? Reputation-building in a university merger. *Crit. AI Perspect. Int. Bus.* **7**(1), 7–29 (2011)
19. Boston, J., Martin, J., Pallot, J., Walsh, P.: *Public Management: The New Zealand Model*. Oxford University Press, Oxford (1996)
20. Chang, H.J.: *Bad Samaritans: The Myth of Free Trade and the Secret History of Capitalism*. Bloomsbury Press, USA (2008)
21. Dunleavy, P., Margetts, H.: New public management is dead: long live digital era governance. *J. Public Adm. Res. Theory* **16**(3), 467–494 (2006)
22. Barzelay, M.: *The New Public Management: Improving Research and Policy Dialogue*, vol. 3. University of California Press (2001)
23. Lane, J.E.: *New Public Management: An Introduction*. Routledge, London (2002)
24. Hood, A.: A public management for all seasons? *Public Adm.* **69**(1), 3–19 (1991)
25. Gleibs, I.H., Tauber, S., Viki, G.T., Giessner, S.R.: When what we get is not what we want the role of implemented versus desired merger patterns in support for mergers. *Soc. Psychol.* **44**(3), 177–190 (2013)
26. Sułkowski, Ł.: *Kulturowe procesy zarządzania*. Difin, Warszawa (2012)



Oriental Lifestyle Construction and Furniture Design Based on a Means-End Theory

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Abstract. Means-end theory indicates the method of personal value affecting individual behavior. It is a research method derived from consumers' cognitive structure. After years of development. This theory has been widely used in the field of marketing. In the model of the means-end theory, it has three levels. The top one is personal value. Different kinds of interests located on a moderate level. The bottom is the attribute of the product. It shows that there is an indirect and deep connection between personal value and product attributes. This study explores the relationship between personal lifestyles and product attributes. Especially how the theory applies to furniture design and development field. Based on this theory, designers designed new furniture collections. Those products have been produced and shown on an international fair.

Keywords: Oriental lifestyle construction · Furniture · Means-end · Italy design

1 Development of Lifestyle

In marketing research, the development of lifestyle construction theory has gone through a long history. In 1963, Lazer had first proposed the concept of lifestyle and introduced it into the marketing research based on the investigation on more clients' information [1]. Subsequently, Wells and Tigert suggested AIO theory based on this concept to analyze the lifestyle, which includes three keywords, that is "activities, interests and opinions" in 1971 [2]. To apply the lifestyle analysis to the adjustment of existing products design strategy, in 1974, Plummer constructed four dimensions of customer attributes according to demographic statistical research in 1974 [3]. Considering the previous works did not reach an agreement as to what is included and excluded in lifestyle analysis, Bushman suggested a practical conceptualization of lifestyle analysis for defining target markets in 1983 [4]. Further, Grunert developed the lifestyle construction within a means-end framework in 1993 to predict consumer behavior in food-related lifestyle research [5]. Since then, lifestyle has become a keyword in the business world.

2 Research Procedure

Currently, research on lifestyle construction has almost become a must-have in the meta-design stage. Different lifestyle positioning has a crucial impact on product design. The main aim of this paper is to study oriental lifestyle construction and furniture design based on the means-end theory. In the Italy furniture industry, furniture design process and method have developed maturely based on lifestyle research. Comparatively, China furniture industry is still struggling at the trial and error stage. Moreover, considering the culture difference between China and Europe, which consequently leads to a change in lifestyle analysis and construction. Current research still has a limitation in the context of Chinese culture. This research took an Italy furniture company, Poliform, as an example to do the case study under a means-end theory. There was a four-step approach, which includes understanding product attributes, functional consequence, emotional consequence, and underlying personal value (Fig. 1).

After finishing the meta-research mentioned above, a workshop has been launched to explore the oriental lifestyle, and then 4 keywords have been extracted. Based on those words, relevant mood boards were produced to catering to emotional consequences. Finally, designers confirmed environmental color, main product color and also some design elements which could be applied to different products as a consistency design, even included some details, etc. Those were product attributes. Finally, a series of furniture sketched up and produced.

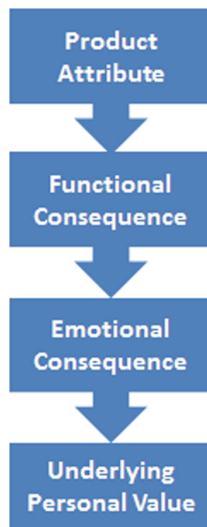


Fig. 1. Case research process based on a means–end theory

3 Workshop on Oriental Lifestyle Furniture Development

3.1 Meta Research and Product Positioning

At this stage, designers picked up several Chinese local furniture enterprises which are based on oriental culture to developing furniture. Designers sorted out and classified those enterprises into three levels. They were basic, moderate and high-end level. Those enterprises have their own market positioning with different design methods.

- (1) Basic level corps and their story theme: those corps are not our research object. They have weak brand awareness. Most of them are more emphasizing “solid wood” on their product. They design their products with classical Chinese furniture elements. Commonly used keywords are rosewood, traditional, real materials and so on.
- (2) Moderate level corps and their story theme: those enterprises have design experience and brand awareness, however, their design ability is still insufficient and their brand structure is not systematic. Most of them still using Chinese traditional design elements directly without transforming. They still have a big chance to go further. Their story theme could be blurry. Commonly used keywords are elegance, humanity, nature, Ming and Qing style, inheritance and so on.
- (3) High-end level corps and their story theme: they are mainly small scale furniture brands with strong design capabilities and build a relatively systematic brand structure. The positioning of their theme story is well refined. Commonly used keywords are literati temperament, elegant, elegant, introverted and a certain Chinese philosophy theme. Designers are well educated with both local and exotic learning experience.

Through discussion, our brand and story theme positioning are in-between moderate and high-end as showing below (Fig. 2). That is mean, our product is creative and relatively has a wider target customer.

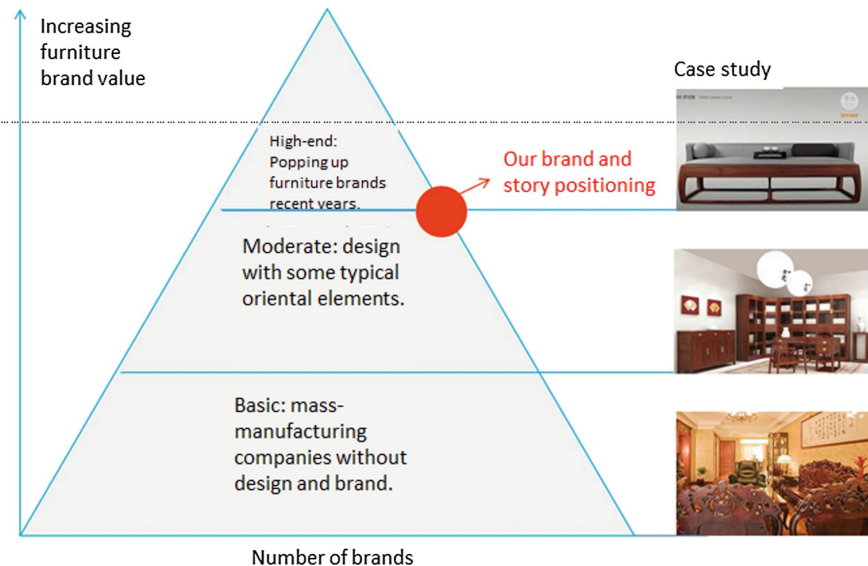


Fig. 2. Product positioning

3.2 Design Keywords

We launched a workshop with ten graduate students. Those students have multiple education backgrounds. Three of them are based on social works. Three of them are major in classical literature. The others are designers. They probed four design keywords through discussion. Finally, these keywords are decided to be: joyful, peace, respect and nimbus. The ten-person group conducted in-depth discussions on each word, then selected representative images and organized them into a moodboard. During the process of images selection, certain principles were followed. Each moodboard includes images with design intentions and ideas, some images include design details or preferences. Here peace moodboard has been taken as an example (Fig. 3).



Fig. 3. Example of peace moodboard

3.3 Product Attribute Research

At this stage, our group continued to refine every detail of the product and create a product line structure, as shown in the following Fig. 4. Gradually refining from the three levels of why, how and what. The following figure shows the workflow of the workshop. From the inner circle to the outside, determined the representative color, typical images and design details that matched with the keyword. Take the peace theme product collection as an example. The design keywords are pure and clear. The representative color is warm white, and the representing character was figured out. So from the product to the entire indoor environment, the main design aim is to create a pure atmosphere for customers.

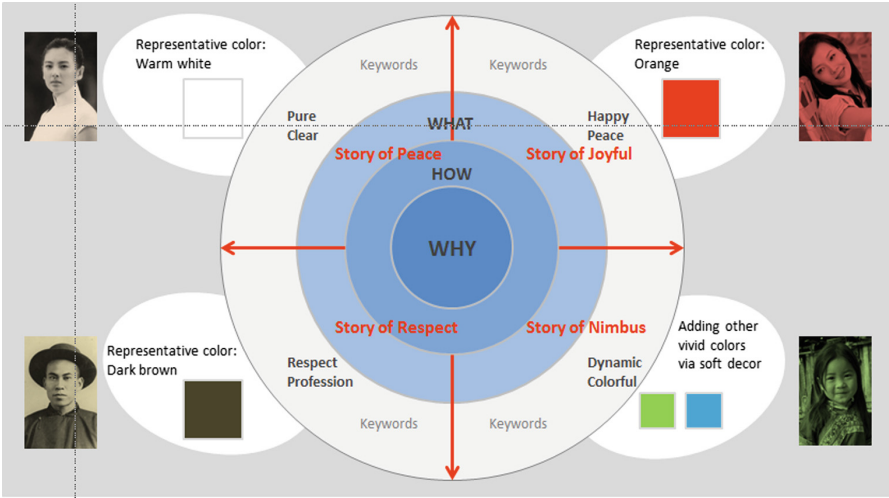


Fig. 4. Research on product attribute



Fig. 5. Render graphs based on peace theme

3.4 Product Design and Evaluation

After theoretically meta-research, the design content became very clear based on detailed design guidelines. At this stage, eight designers were organized to design products in terms of the four themes according to the design guidelines. Every two designers designed a product collection under one theme. After nearly half a year of continuous design modification and improvement, the final design render graphs were shown in the following Fig. 5. Furthermore, most of the products have been manufactured and shown up on the Shanghai International Furniture Fair, in addition, one collection won the silver award.

4 Conclusion and Prospects

Through this research, we found that although the means-end theory is widely used in the marketing field to promote sales by studying consumer behavior. However, this study achieved unexpected results by following the means-end process framework to design furniture products. The final product not only has an oriental style but also with a more advanced design method. Designers did not steal the ancient design element directly. The product and the indoor environment are coordinated and conformed to the established design theme.

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References

1. Laizer, W.: Life style concepts and marketing. In: Greyser, S. (ed.) *Toward Scientific Marketing*, pp. 130–139. American Marketing Assn., Chicago (1963)
2. Wells, D.W., Tigert, D.J.: Activities, interests, and opinion. *J. Advert. Res.* **11**, 27–35 (1971)
3. Joseph, P.T.: The concept and application of life style segmentation. *J. Mark.* **38**(1), 33–37 (1974)
4. Bushman, F.A.: Systematic life styles for new product segmentation. *J. Acad. Mark. Sci.* **10** (4), 381–391 (1982)
5. Grunert, G.: Klaus towards a concept of food-related life style. *Appetite* **21**(2), 151–155 (1993)



Evaluation and Prediction of the Financial and Management Indicators in SME'S with the Use of Artificial Neural Net

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Abstract. In this work, we proceed with the study and analysis of a model that facilitates the evaluation and prediction of financial and management indicators of SMEs. The model is based on the use of Artificial Neural Networks (ANN) as a data-mining tool that, supported on the financial statements, contributes to the evaluation and forecasting of liquidity, debt, performance, efficiency and profitability indicators, following the DuPont system. The objective of the work is to assess and forecast the financial situation of SMEs for proper management decision making in organizations. The model focuses on two interrelated phases, the estimation-diagnosis phase and the forecast phase. The conclusions show the predictive feasibility of using neural networks for financial indicators.

Keywords: SMEs · Financial statements · DuPont system · Artificial Neural Networks (ANN)

1 Introduction

Currently, in the business sector, small and medium enterprises (SMEs) are essential for boosting the economy and the growing market; research associated with this type of enterprise is extremely important in the economic and social performance of any country, due to its capacity to generate production, employment and its impact on income distribution [1]. One of the greatest challenges for SMEs is to achieve adequate administration and management of their financial resources [2]. Adequate financial management based on making the right decisions from the companies' financial statements. In the current research, variations in financial indicators considered on a weekly basis as a database for the implementation of an artificial neural network. Their implementation allows the evaluation and forecasting of the company's financial situation.

Some authors argue that the insufficiency of financing and long-term investors in SMEs is the result of the distrust of credit institutions due to difficulties in presenting the financial conditions of companies [3]. These elements are constraints that affect the continued growth of the organization. The application of a model that facilitates the

evaluation and forecasting of financial indicators provides planning, organization, execution and decision-making within SMEs. Various studies and research on corporate financial management assessments have been carried out based on financial analyses, and the information collected is limited to the time when the indicators are calculated at the end of the period. However, the fluctuations in the indicators are not permanently studied in depth in order to establish analyses of trends in each of them.

However, some investigators state that for the prediction and classification of information it is necessary to define the appropriate model [4]. Usually statistical models are used (multiple regression, discriminant analysis and logical regression), which in the area of prediction are very similar to ANNs, but at the same time in the aspects of classification ANNs have a much higher performance than statistical models, generating trend lines with significantly small error margins in relation to statistical models. In the analysis of the financial information, there are problems of prediction based on the quantitative data of the financial ratios and of classification taking into account the qualitative information that allows us to give criteria of solvency, performance and profitability.

2 DuPont Financial Indicators and the SME'S Management

From the elements reviewed above, it can be seen that the incorporation of new predictive methods allows for the establishment and prediction of the financial situation of a SME; an aspect that in financial management envisages a possible crisis due to insolvency, low profitability or inappropriate use of assets, among others. Companies traditionally set financial targets based on their financial analyses [5]. The inappropriate use of financial information hinders compliance with financial planning by establishing high-risk situations for businesses. On the other hand, it is known that the entrepreneur responsible for SMEs, in most cases, is unaware of the need to anticipate problems, and is surprised by situations that could have been avoided with an adequate financial control system, given that companies base their decisions on financial information to create competitive advantages [6].

A major financial indicator in financial decision-making within the company based on efficiency and profitability and their impact on return on assets (ROA), is DuPont analysis [7]. The application of the DuPont system began at the General Motors Company, created by Donaldson Brown, an engineer from the DuPont Corporation, a company that acquired shares of General Motors in 1914. The essence of the DuPont model lies in the evaluation and prediction of economic and operational performance of a company; relating the main financial indicators to determine the efficiency with which the company is using its assets, working capital and financial leverage. The DuPont system, known as Return on Equity (ROE), is derived from the product of Return on Assets (ROA) for Financial Leverage (FL).

$$\text{ROE} = \text{ROA} * \text{FL} \quad (1)$$

The ROA is the result of the product of the net profit margin (PM) by the rotation of total assets (TA). A clear way of seeing how the system is structured can be seen in next figure (Fig. 1).

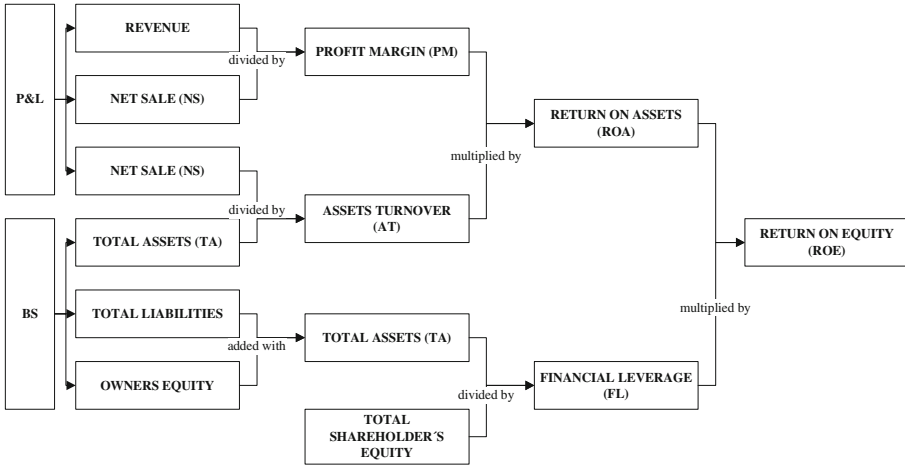


Fig. 1. Structuration of DuPont analysis

The financial information to determine these values is obtained from the 2016, 2017 and 2018 statement of Profit and Loss (P&L), calculating the company’s capacity to generate profits from sales; and from the Balance Sheet (BG) of the same years, considering the company’s capacity to generate sales through resources (investments in working capital and fixed assets) with financing [8]. This article evaluates and forecasts the three variables that govern this system, and establishes an evaluation and forecast of the monthly behavior of each of the financial indicators that compose the system using artificial intelligence, specifically the artificial neural networks (ANN).

Some authors [7–9], record works and approximations to the diagnosis and measurement of financial efficiency using the DuPont model, with the detail that none of them uses neural networks to determine the variables of the ROE.

3 Evaluation and Prediction of Financial Indicators Using ANN

Artificial Neural Networks (ANNs) have stood out in recent years within data mining investigations; their models have the characteristic of deciphering patterns through learning algorithms based on existing data [10]. This particularity of modeling and learning from existing data facilitates its predictive character. The use of NNAs in the business sector began to boom at the end of the 1980s and beginning of the 1990s, where the model based on Artificial Neural Networks applied in the Spanish stock

market highlighted, where its superiority with respect to traditional multivariate statistical methods evidenced.

Subsequently, banks began to use the predictive power of models based on Artificial Neural Networks such as the PCML (Public Company Loan Model), a multilayer model that used to decide the granting of credit in the Chase Manhattan Bank; its use later became widespread in the business sector to predict insolvency and profitability from financial statements.

On the other hand, some authors explain that neural networks begin their business use when the BP algorithm is developed at the end of the 1980s. Its introduction was motivated by the desire to improve the results achieved with statistical models (mainly discriminant analysis and logistic regression), as these provide decision-making regions defined through linear functions; while with the insertion of hidden layers of neurons in a perceptron model it is possible to define much more complex regions and thus reduce the number of incorrectly classified companies [11].

3.1 ANN Application for ROE Prediction

Based on the interrelation determined by the independent variables (Month, Net Profit and Total Assets) and the dependent variable (ROE), an algorithm is established that allows the hierarchical execution of the prediction process and the implementation of the procedures that characterize it. In this way, it is necessary to introduce data, validate them, and execute ANN with its input parameters in order to generate the prediction of ROE values. It is necessary that the predictions made by ANN are stored in a database and compared with the real values of ROE compartment once they are obtained in the operational reality of the company. This data storage will allow ANN to obtain the necessary information for a certain cycle of time to perform a re-training and adjustment to the conditions and financial evolution of the company, so ANN can self-manage learning levels over time and better represent the future compartment of the indicator under study. In Fig. 2, show the prediction process algorithms of ROE with ANN.

For the development of ANN in Matlab Software, the Toolbox was available by accessing the “nnstart”; command and selecting an ANN of the “Neural Fitting”; type. This type of network allows solving Feed-forward type input-output problems and uses the “Perceptron Multilayer”; model, and integrates the “Back-propagation”; algorithm for the weighting of the parameter interrelation error [12]. In next Fig. 3, it shows the ANN structure.

The previous Fig. 3 shows the interaction of the three independent variables processed. In the input layer and the assignment referring to the weights granted to the reference month for the prediction, the net profit and total shareholder equity, which deliver as a result a single “output”; or output in the “output layer”; that corresponds to the prediction of the ROE as an ANN-dependent variable.

Once the ANN architecture was established, the Data for Learning, Validation and Network Testing was introduced. Each of these stages yielded the equations of dependence, weights, and the quadratic mean error of the corresponding regression process. It should be noted that in none of the three stages did the correlation error

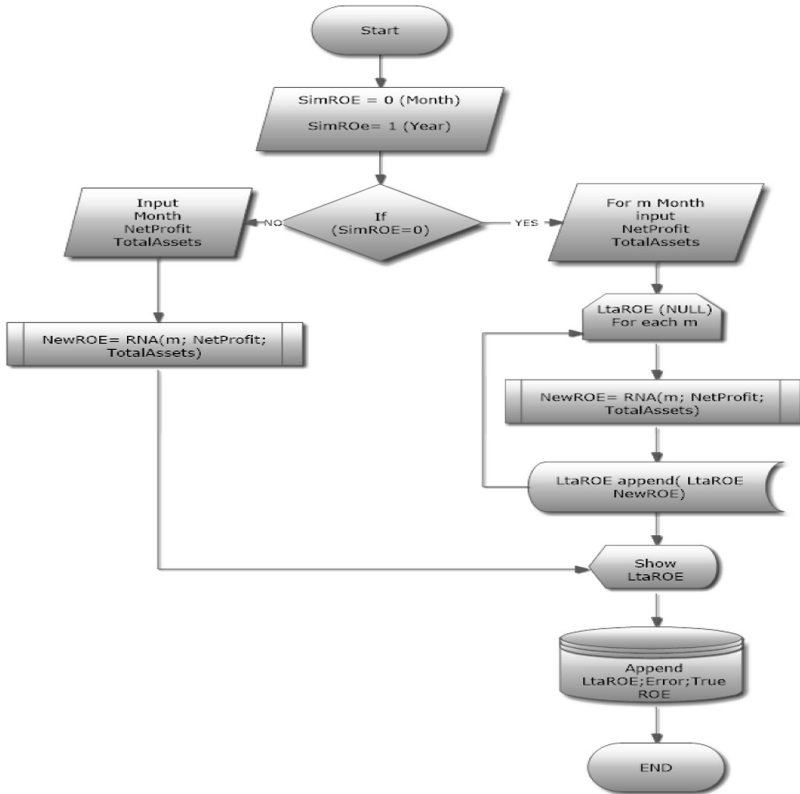


Fig. 2. Process predictions algorithms of ROE with ANN

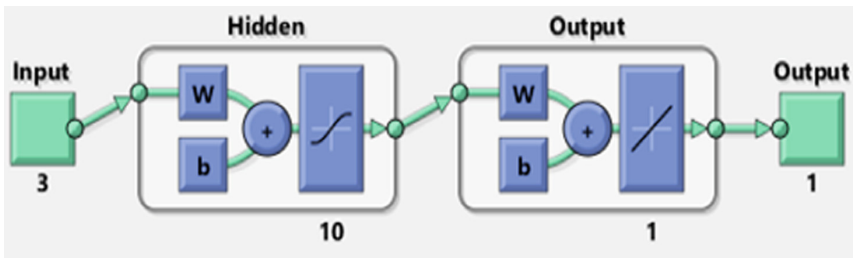


Fig. 3. ANN architecture

between dependent and independent variables exceed 2%, so ANN has a prediction level of more than 98% confidence how it shows in Fig. 4.

After that the ANN had been modeled, an interface was developed with the use of the GUI (Graphic User Interface) corresponding to the prediction variants described in the system's general algorithm. The prediction window for one month allows the user to easily and intuitively establish the values of independent variables and analyze the

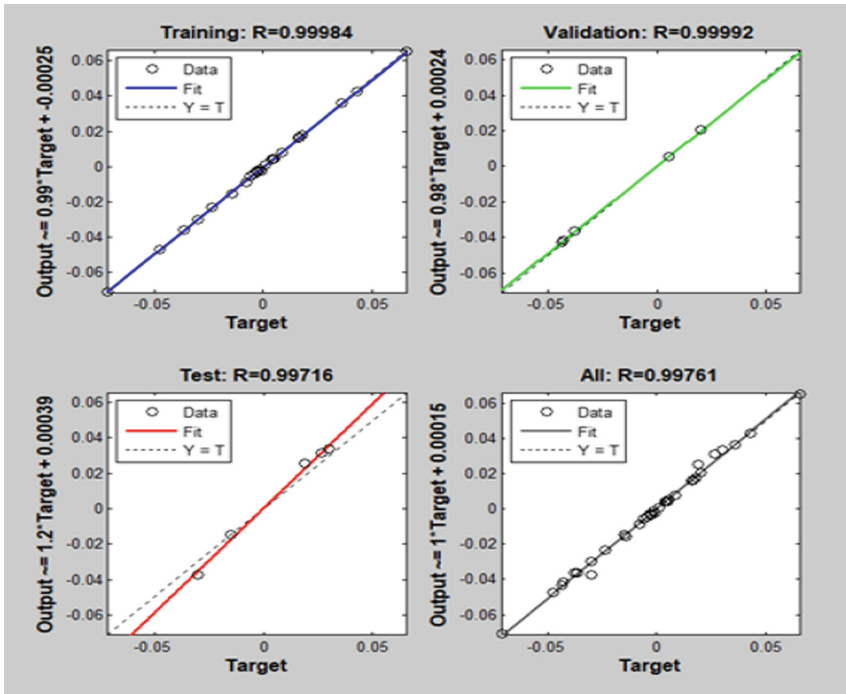


Fig. 4. Linear regressions of each stage of the ANN

prediction values graphically and numerically for better interpretation and decision-making. The interface is show in the Fig. 5.

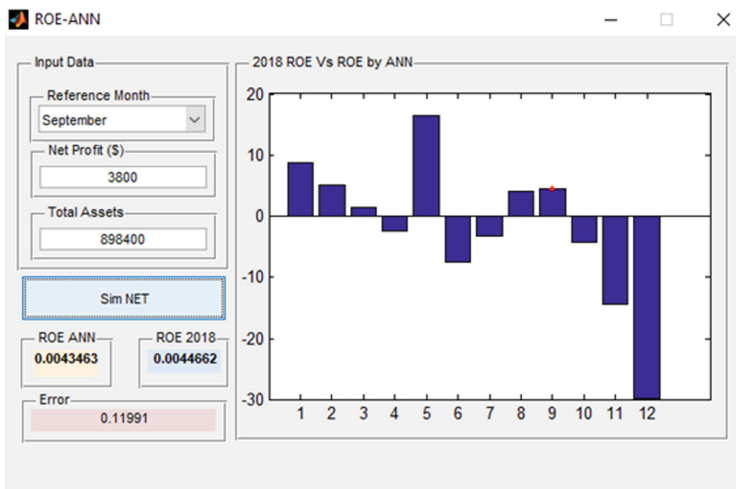


Fig. 5. Monthly predictions interface in ANN

The interface for the prediction or estimation of the ROE for a whole year uses UITABLET type controls for data collection and the visualization of prediction and error. It should be noted that predictions were made for each month of 2018 and compared with the values that describe the real behavior of the ROE in that year; resulting in the evaluation that the maximum error was established in the month of December with a 1,5% error between the prediction of ANN and the result obtained by the company at the end of the year (Fig. 6).

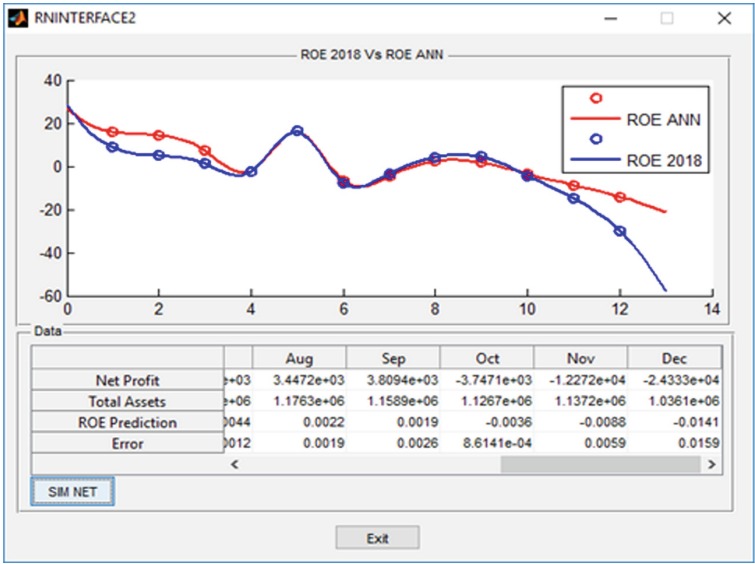


Fig. 6. Yearly predictions interface in ANN

The results obtained show the high level of incidence of the net profit margin and total assets in the ROE, both monthly and annual. The feasibility of using artificial intelligence tools in financial studies for business decision making was also observed. Another significant factor seen in the research is that the artificial neural network methodology is a very useful and accurate tool for predicting financial indicators. The programmed network had a reliability superior to 99% in each one of its phases, with an average error of 1.5%, indicating the feasibility of the model. With the application of these tools, SME financiers can establish better strategies focused on the adequate return on assets and make the best decisions for the organization.

References

1. Anderson, J., Romero, E.: Colombia y los estándares internacionales de contabilidad para las PYMES. Argentina: El Cid Editor (2009). <http://site.ebrary.com/lib/unalblogsp/Doc?id=10316760&ppg=5>
2. Terrazas, P.R.: Modelo de Gestión Financiera para una organización. Revista Perspectivas. núm. 23, enero–junio, 2009, pp. 55–72. Universidad Católica Boliviana San Pablo Cochabamba, Bolivia (2009)
3. Boedo Vilabella, L., Calvo Silvosa, A.: Problemas en el contraste de las hipótesis del tipo impositivo y del ahorro fiscal de DeAngelo y Masulis. Una aplicación empírica al caso español. Revista Europea de Dirección y Economía de la Empresa. **10**(3), 97–112 (2001). España
4. Pitarque, A., Roy, J.F., Ruiz, J.C.: Redes neurales vs modelos estadísticos: Simulaciones sobre tareas de predicción y clasificación. *Psicológica*. **19**, 387–400 (1998). España
5. Mosqueda, R.: Indicadores del fracaso empresarial en las empresas mexicanas México D.F.: Instituto Mexicano de Ejecutivos de Finanzas. México (2008)
6. Argüelles, A., Quijano, R.A., Fajardo, M.J., Magaña, D.E.: La supervisión, su impacto en la rentabilidad financiera de las PyMes. Sector Manufacturero. In: Global Conference on Business and Finance Proceedings, Hawaii, vol. 7, no. 2, pp. 870–874 (2012)
7. Dehning, B., Stratopoulos, T.: DuPont analysis of an IT-enabled competitive advantage. *Int. J. Account. Inform. Syst.* **3**(3), 165–176 (2002). USA
8. Restrepo-Morales, J.: Una aproximación Estocástica al Impacto de los Inventarios en las empresas comercializadoras de Izúcar de Matamoros mediante análisis del indicador Dupont y el Punto de Equilibrio. *Vinculategica*. **1**, 198–226 (2014). México
9. Chang, K., Chichernea, D., HassabElnaby, H.: On the DuPont analysis in the health care industry. *J. Acc. Public Policy* **33**(1), 83–103 (2014)
10. Allende, H., Moraga, C., Salas, R.: Artificial neural networks in time series forecasting: a comparative analysis. *Kybernetika*. **38**(6), 685–707 (2002). Bilbao
11. Carmona, E.G.: Estudio sobre los diferentes modelos de redes neuronales aplicados en las finanzas. Universidad Popular Autónoma del Estado de Puebla, México (2009)
12. Lastre, A.M., Mendez, E. Cordoves, A.: Automated system for load flow prediction in power substations using artificial neural networks. *Enfoque UTE*. **6**(3), 20–35 (2015). Ecuador



Image and Brand Awareness in Universities in Consolidation Processes

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Abstract. Brand management in the university merger process is of strategic importance from several points of view. The international and national recognition of universities for students and other external stakeholders depends, among other things, on the university's brand. In international and national rankings, consolidated and previously separate universities operate under one name. In Sweden, from the merger of University College Kalmar (HiK) and Växjö University (VxU), a consolidated university was established, which is called Linnaeus University. This is an example of shaping the identity and brand, which allowed to increase the attractiveness of the institution, which also translates into a significant increase in interest from foreign students.

The aim of this article is to analyze the image and brand awareness in universities in consolidation processes. The article discusses the complexity of the image and brand awareness. The research methodology was based on qualitative research - case studies of universities in Europe.

Keywords: Consolidation processes · Image and brand awareness · University management · Higher education sector

1 Introduction

Building reputation through intensive communication, marketing and internal branding employer branding activities is gaining importance in the academic world. Branding and image are concepts related to reputation, and they are also associated with culture and organizational identity [1]. All these areas of the organization's activity are subject to profound transformations in the processes of mergers and acquisitions. The area of the brand, although it is important for various aspects of the organization's operations, is most often analyzed on the basis of marketing.

University mergers mean the time of change and fundamental choices, including the area of brand strategy. A global race for prestige, reputation and the position in world rankings favors the development of marketing activities in the academic world. In the merger processes, universities create completely new brands, just like the case of Université Grenoble Alpes described in this book, the Finnish Aalto University most frequently described in the literature and many others. Universities use the concepts of marketing communication, brand management and organizational identity. This is part

of a more general trend related to the economisation of social life, and thus - with the expansion of management concepts and methods.

The higher education sector is influenced by a number of environmental factors that include legal, economic, demographic, social and cultural variables. Thus, the key promotional activity will be the pursuit of increased student satisfaction and building the image of the university, which is the subject of relationship marketing. In addition to the promotional sphere, evolution in the field of market research and marketing strategy development is also evident [2]. While, in the 1990s, tactical and operational activities dominated in the marketing of higher education institutions based on the experience and intuition of managers, at the beginning of the 21st century, universities are increasingly conducting their own research on the educational market and acquire reports prepared by specialized units and more and more often develop marketing strategies to achieve market goals. Marketing activities undertaken by universities have largely evolved. Today's promotion of the university is not only limited to presenting the offer using leaflets, catalogs or, possibly, a website. Observing the process of transforming the marketing activities of the university, one can notice the growing importance of the concept of relationship marketing in the promotion of these units.

2 Selected Marketing Tools that Build the Image of the Brand Awareness of Universities

A. Stewart takes a different position, in the publication "does customer satisfaction mean only the fulfillment of his expectations" he lists six determinants that affect customer satisfaction: (1) customer expectations for the creation of which the company is responsible, (2) information for the client, (3) satisfaction with information after the purchase/use of the product, (4) the client's involvement in the product, (5) the mood and other emotions of the client, and (6) the image of the company.

A multitude of factors affecting customer satisfaction forces companies to carry out earlier segmentation in order to individualize the offer for the client. Peppers, Rogers and Dorf pointed to two stages that are an important element of the segmentation process: ordering customers according to the value for the company and organizing them according to their needs [3]. As a result of segmentation, a group of customers will be separated, which creates a chance for the company to obtain a refund of costs related to the adjustment of the offer. Summing up, the implementation of the customer segmentation process in accordance with the concept of relationship marketing requires the company to take into account the long-term value of the client and his needs.

A controversial problem in the case of universities is student surveys to assess the teaching staff, especially independent scientific staff. In some universities student surveys do not include independent academic staff, in others the assessment is indirect (classes are assessed rather than the teachers). The results of student assessments in relation to academic teachers must be treated in a particularly delicate and reflective manner. It is worth paying attention to the problem of short-term and long-term student satisfaction. The aim of university education is to provide the student with the highest level of competence, which serves the long-term satisfaction of the student and later the graduate and broader social interest. All activities of the university should be

subordinated to the implementation of its educational mission. Sometimes, however, students rate higher those academic teachers who have lower requirements. In such cases they focus on short-term satisfaction related to obtaining a higher final grade or easier completion of the subject. Thus, the problem of low grades of teaching staff should be recognized using other methods of verifying the survey, such as class visits by supervisors of an academic teacher. Only then will it be possible to balance the assessment for increasing customer satisfaction.

Summing up the pursuit of increased customer satisfaction, it affects the competitiveness of the company in the sector. Such actions are also justified in the activities of universities. High competition in the sector of higher education services has a significant impact on the university's desire to increase the satisfaction of its students with the services they offer. In the theory of marketing the student's satisfaction translates into the competitive position of the university.

When starting the discussion on the role of the client in the process of building the concept of relationship marketing, one should consider the question: "who is the client?". There are many definitions of the client in the literature on the subject, however, from the point of view of the concept of relationship marketing, the definition of Armstrong, who considers the client to be a person who requires professional advice and assistance when buying seems to be most useful [4].

Customer individualization is the process of customizing the product to unique and individual customer needs. It is a departure from mass marketing and unified marketing that treats customers in a uniform manner, within assumed, usually fairly wide market segments. Customer individualization carries with it an objective and subjective aspect. In the objective sense, it is an assumption in the marketing process that relationships are individual in nature, i.e. the basic level of marketing is customer-organization contacts. Therefore, strategy planning, market research, product development, marketing communication are done with the individual client in mind, rather than broad segments. In the subjective sense, individualization is the acceptance and affirmation of the sense of individuality and uniqueness of each client. Therefore, each client is different, has his own needs, aspirations, images about himself, and the task of the organization is to recognize and satisfy those needs, respecting and even strengthening the subjective and individual feeling of client's uniqueness. In order to realize the assumption of objective and subjective individualization, it is necessary to gain knowledge about the client that allows to treat him in a unique way. According to I. H. Gordon is one of the factors of effective relationship marketing is customer knowledge. J. Fazlagić states that "knowledge is the ability to act effectively, whereas information is just "knowledge of things". However, the starting point in the customer's individualization is the data about him.

The concept of quality has been the subject of considerations for many academic researchers and practitioners. Although the notion of quality has been functioning for several decades, it is difficult to indicate one commonly accepted definition. In the literature on the subject, many definitions and positions can be found that testify to the complexity of the concept described. Garvin, distinguishes five views on quality: a transcendental view, a view based on consumer assessment, a view based on product characteristics, and a view based on the evaluation of the production process and an opinion based on value assessment [5]. The first definitions of quality referred to the

definition of product quality, now much more attention is devoted to the quality of services. Team of researchers: Parasuraman, Zeithmal and Berry defined the quality of services as “the level of positive gap between consumer expectations or desires and their perception of services” [6]. In turn, R. Griffin defines quality as “the totality of product or service features that determine their ability to satisfy identified and potential needs”. Analyzing the literature of the subject, one can notice a close connection between quality and customer satisfaction.

In the literature on the subject, a lot of space is devoted to the issue of the quality of education at the higher level. The quality of university education services can be compared to the driving force that creates its competitive advantage. As is clear from the definition of the quality of the service presented by S. Trawnicka: “the quality of the service is the total features condition of the service that determines its ability to meet identified or anticipated needs”, research and forecasting the needs of university clients plays a key role. Analyzing the quality in higher education, it can be divided into: hard quality and soft quality. This division systematizes the areas in which quality assessment in universities can be made.

In hard quality, the following can be assessed:

- university infrastructure (buildings, library equipment, classrooms, number of places in dormitories, etc.);
- location (access for students, communication, infrastructure scattering);
- teaching staff (number of people with academic degrees and titles: Prof., PhD, dr hab.);
- administrative staff (number and qualifications of administrative staff to serve students).

However, in soft quality, you can analyze:

- level of education;
- places in university rankings;
- types and forms of studies;
- organization of classes.

With regard to the quality of education, the key role is played by the level of education, which is reflected in the competences of university graduates seeking their place on the labor market. The quality of education depends both on the quality of the academic staff and the infrastructure of the university, as well as on the adopted strategy and the reputation of the university. Therefore, in Poland, apart from universities oriented at improving the level of education, there are higher schools that do not seek to increase the quality of education, and are seeking for other sources of competitive advantage. It seems that in the long-term the orientation on the increase in the level of education is a key element of competitive advantage. Universities, depending on the adopted strategic goals, provide education to different groups of students, however, all in the long-term should focus on the educational mission, the foundation of which is to improve the level of education.

Two authors Schuller and Fuchs stated: “full loyalty of customers and employees - is that not a dream of every entrepreneur and manager?” [7]. The analysis of the literature on the subject presents different definitions of customer loyalty. According to Jacoby and Chestnut the concept of loyalty means: “targeted behavior, expressed over a

long period of time, being a function of psychological processes, such as making decisions or valuing a chosen brand, while respecting alternative brands” [8]. In turn, Barry, Brown and Gunst define loyalty as: “continuous or intentional performance of activities that benefit the object of loyalty and which are done instead of alternative behaviors beneficial to objects other than the object of loyalty” [9]. Literature analysis points to various forms of definitions provided by the authors, however, in most publications one can see a common position stating that the customer’s participation in the loyalty program is a regular, repeated purchase.

The concept of loyalty programs has found its application in the marketing activities of universities. The higher education sector is an example in which repeatability of purchase does not play a significant role in defining loyalty. Measures of loyalty will be the strength of identification with the home university, the tendency to strengthen its good image, readiness to participate in the university activities while studying and after graduation, readiness to support the university activities and other manifestations indicating a positive relationship with the university. Loyalty activities of universities are directed to two groups of entities: to students and graduates. Building loyalty in the higher education sector in Poland is largely spontaneous because it is based on the assessment of the quality and value of the student’s competences and relationships. If the student’s assessment is negative, the loyalty programs do not matter. Loyalty is a measure of the student’s or graduate’s identification with the university, so the image and reputation of the university also play an important role. Among the specific techniques of marketing impact of universities, one can point to a number of long-term and short-term loyalty programs. Techniques for creating clubs and associations of both students and graduates are offered, which offer privileges related to participation. An important group to which university’s loyalty programs are addressed are its graduates. Universities very often associate graduates in organizations with the help of which the information database about the university alumni is built and regular alumni meetings are organized. Other examples are systems for reducing education costs related to the recommendations of students or graduates. In some universities, the role of loyalty is played by career offices that help students choose their professional path. By building long-lasting relationships with students, universities use loyalty programs for this purpose. These programs are increasingly taking more and more advanced forms from year to year, analogically to the loyalty programs offered by service companies.

By stakeholders, we can understand collective entities that form relationships with the university relevant to its functioning. Colloquially, entities that “have an interest” in the activities of the university can be considered as “stakeholders”. This group includes, for example, besides students: university founders, employees, trade unions, local government authorities and other entities. A special group of stakeholders are the entities regulating the functioning of the higher education market, i.e. the Ministry of Science and Higher Education, the Central Council of Higher Education, the State Accreditation Commission, the State Commission for Degrees and Titles. The very concept of cooperation with regulators does not raise so much controversy in Poland, unless it takes forms called lobbying. This form of cooperation, despite being regulated by law, enjoys a very bad reputation. In theoretical considerations, lobbying is included in PR companies’ tools. J. Pilczyński claims that lobbying serves to level the playing field. On the other hand, B. Tarczydło defines lobbying as “establishing direct relations

and personal contacts between the pressure group (lobby) and the addressee”. However, the most precise position in defining lobbying is presented by E. M. Cenker for whom lobbying is “one of the means to influence political decisions and the shape of laws or ordinances through participation in the process of creating, modifying or repealing individual legal acts”. The literature on the subject also specifies the addressees of lobbying activities, who are: people responsible for making decisions, among others MPs, ministers, national and global press, public opinion [10]. The authors also stated that lobbying conducted according to the rules is something natural and should not raise so much controversy. In the higher education sector, regulators are all administrative units affecting universities.

3 Case Study

The processes of universities consolidation are also related to the choice of brand management strategies. Usually at the beginning of the process we deal with two (or more) university brands that are consolidated. University mergers can lead to several possible strategic solutions that have been ordered by frequency of occurrence category.

The first, most common solution is the adoption of one dominant university brand that is a stronger partner in the merger process. This strategy can be referred to as keeping the brand. This is a case usually found in mergers in the forms of incorporation and absorption [11]. An example of such strategy is the incorporation of the Medical Academy into the Jagiellonian University in 1993. The name and symbolism of the Jagiellonian University are invaluable due to the university’s history and its significance for culture and national identity. It is a symbolic capital that should also be used to make the University a global brand.

The second strategy related to brand retention is the modification of the university’s name and logo. It is based on leaving the existing university brand, but adding a significant change strengthening the brand. The advantage of this strategy is to maintain the continuity, while enhancing the brand with a significant identifying element. The disadvantage is the limited possibilities of actually strengthening the brand in practice.

The third strategy that accompanies the merger is the change of the brand, i.e. the total rebranding. A merger is a radical change that can also be passed on to employees, students and the environment by changing the name and logo of the university.

An example of rebranding is also the creation of a federational university in France at the beginning of the 21st century. Université Grenoble Alpes was founded in Grenoble through the merger of three universities operating in this region. The creation of the new brand is accompanied by similar dilemmas as in the case of Aalto University. The brand is new, which means initially poor recognition. The employees of the merging universities may have a sense of acculturation and loss of continuity. The name of the university was designed from scratch, which allowed to use the concepts of effective marketing communication and public relations.

There are many more examples of creating new university brands successfully, as a consequence of mergers, that can be found in different parts of the world. In Sweden, through the merger of University College Kalmar (HiK) and Växjö University (VxU), a

consolidated university was established, which is called Linnaeus University. This is an example of shaping the identity and brand, which allowed to increase the attractiveness of the institution, which also translates into a significant increase in interest from foreign students [12].

4 Conclusion

Marketing as a tool supporting the process of building a competitive advantage has been used in companies for decades. In the initial stages of applying the concept of marketing, the classic approach reigned, which has undergone far-reaching changes over the years. Today's companies use sophisticated forms of marketing in their marketing programs. It should be emphasized that the choice of a given form of marketing activities depends primarily on the situation in the sector, which consists of several complex variables: economic situation of companies, demand for products or services, level of competition, but also socio-cultural variables.

In recent years, the growing importance of tools building the image of the university's brand is noticeable. Increasing competition forced universities to use other concepts than the classic idea of marketing. Universities quickly recognized the positive effects of building positive relationships with the environment. In this way, the construction of marketing relations at the university has evolved and now takes on a variety of forms. An important element in the marketing management process of a higher school is taking actions aimed at clients, competitors and cooperators.

Hope claims that the image of the university consists of several factors, he includes quality and type of information provided, kindness of the dean's office staff, external activity of the university to the basic ones [13]. Thus, the implementation of the concept of relationship marketing in the higher education sector is becoming more and more common. The use of relational tools depends mainly on the specifics of the market on which the university operates. When assessing the usefulness of relationship marketing in creating the overall image of a university, it can be concluded that the tools of this concept significantly strengthen the relationship between the university and the environment. It can be predicted that over the years this concept will become the main direction of marketing activities of universities in Poland.

References

1. Aula, H.M., Tienari, J.: Becoming "world-class"? Reputation-building in a university merger. *Crit. Perspect. Int. Bus.* 7(1), 7–29 (2011)
2. Seliga, R., Sulkowski, Ł., Woźniak, A.: Barriers to university mergers - comparative analysis of universities in Europe. In: *Proceedings of the AHFE 2018 International Conference on Human Factors, Business Management and Society. Advances in Human Factors, Business Management and Society*, vol. 783, pp. 558–567. Springer (2018)
3. Peppers, D., Rogers, M., Dorf, B.: *The OnetoOne Fieldbook. The Complete Toolkit for Implementing a 1 to 1 Marketing Program*. Doubleday, New York (1999)
4. Armstrong, M.J.: Students as clients: a professional services model for business education. *Acad. Manag. Learn. Educ.* 2(4), 371–374 (2003)

5. Garvin, D.: *Managing Quality*. The Free Press, New York (1988)
6. Parasuraman, A., Zeithmal, V.A., Berry, L.L.: *Delivering Quality Service. Balancing Customer Perceptions and Expectations*. The Free Press, New York (1990)
7. Schuller, A.M., Fuchs, G.: *Total Loyalty Marketing*. HDT Consulting, Warszawa (2005)
8. Jacoby, J., Chestnut, R.W.: *Brand Loyalty Measurement and Management*. Wiley, New York (1978)
9. Barry, T.E., Brown, T.J., Gunst, E.: *Delivering bonding and binding: the influence of customer satisfaction, identification and perceived switching costs on consumer loyalty*. In: *Conference of Association for Consumer Research* (1997)
10. Mastromarco, R.: *Sztuka lobbingu w Polsce*. Przewodnik, USAID/GEMINI Poland Small Business Project, Warszawa (1997)
11. Sułkowski, Ł.: *Meta-paradigmatic cognitive perspective in management studies*. *Argumenta Oeconomica* **22**(2), 33–51 (2012)
12. Geschwind, L., Melin, G., Wedlin, L.: *Mergers as opportunities for branding: the making of the Linnaeus University*. In: Pinheiro, R., Geschwind, L., Aarrevaara, T. (eds.) *Mergers in Higher Education. The Experience from Northern Europe*, pp. 129–143. Springer International Publishing (2016)
13. Hope, E.: *Public relations uczelni, czyli szewc bez butów chodzi*. In: *Public relations instytucji użyteczności publicznej*. Scientific Publishing Group, Gdańsk (2005)



Self-leadership Development Program in Elite Youth Soccer Players in Japan

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Abstract. Teams are used in various situations. For example, job execution and business solutions are usually performed by teams. Therefore, a synergy effect is expected to result by combining limited resources within a team. What is the key factor of an excellent team? This proposition is an eternal issue for sport teams, too. On the other hand, youth generation players learn about the severity of becoming professional football players, look at the reality myself and image for the future. In other words, youth players seriously seek out the problem of how they live in the real society, it is time to establish themselves (Erikson 1959). Therefore, we conducted the Self-leadership development program which applied the organization development methods to the two elite youth soccer teams (under 18 ages) belonging to the J-League (professional football league in Japan) in 2018. One team was consisted of 27 females (Mage = 15.96, SD = 1.285). On the other team was consisted of 40 males (Mage = 15.88, SD = .791). We used Sport Self-management Skill scale (Takemura et al. 2013), the Belief in Cooperation Scale (Nagahama et al. 2009) and Collective Efficacy Questionnaire for Sports (Short et al. 2005) to examine the effects of this program from a perspective. From the analysis, it was shown that the score of Sport Self-management Skill, Belief in Cooperation and Collective Efficacy improves by this program ($p < .05$). These results suggest that this program is effective for promoting human resource development for elite youth soccer players, and it can be said to be a practical and academically important discovery.

Keywords: Team building · Self-management Skill · Intervention ·
Todai Personality Inventory · Human resource development ·
Organizational development

1 Introduction

Teams are used in various situations. For example, job execution and business solutions are usually performed by teams in recent years. Therefore, a synergy effect is expected to result by combining limited resources within a team [1]. What is the key factor of an excellent team? This proposition is an eternal issue for sport teams, too. Understanding the key factors that make an excellent team is an ongoing issue for sports teams. Japan's football is based on the club system in Germany and is constructing an organizational system with the Japan Football Association (JFA) at the top. In order to compete with the world on equal levels, JFA carries out overall approach to National team's strengthening, youth development, coaches training [2, 3]. On the other hand, youth generation players learn about the severity of becoming professional football players, look at the reality myself and image for the future. In other words, youth players seriously seek out the problem of how they live in the real society, it is time to establish themselves [4]. How do practical issues reconcile organizational and personal harmony? In other words, it is necessary to have a practical approach to improve team effectiveness and individual human resource development.

Collective efficacy has been drawing attention in recent years. Collective efficacy refers to a "group's shared belief in its conjoint capabilities to organize and execute the courses of action required to produce given levels of attainments" [5, p. 477]. Some research has shown that there is a positive relationship with collective efficacy and team effectiveness [6–10]. Furthermore, Takemura [11] pointed out that it is necessary to focus on the ability of individual players in the group not only group cohesion and collective efficacy, and It points out the importance of sports self-management skills [11].

Therefore, we conducted the Self-leadership development program which applied the organization development methods to the two elite youth soccer teams (under 18 ages) belonging to the J-League (professional football league in Japan) in 2018. We used Sport Self-management Skill scale [11], the Belief in Cooperation Scale [12] and Collective Efficacy Questionnaire for Sports [13] to examine the effects of this program from a practical perspective.

2 Methods

2.1 Participants

This research carried out in two elite youth soccer teams (under 18 ages) belonging to the J-League (professional football league in Japan) in 2018. One team was consisted of 27 females (Mage = 15.96, SD = 1.285). On the other team was consisted of 40 males (Mage = 15.88, SD = .791)

2.2 Self-leadership Development Program

The Self-leadership development program based on OD methods [14], had the theoretical background of the Transactional Analysis—focused on human relations. Then, this program had been designed by Kitamori who was structured the OD program in Japan [15, 16]. In this program, learning experience and many of the image

replacement performed. Furthermore, this program was composed of specialized tools such as TPI (Todai Personality Inventory) [17] based on MMPI (Minnesota Multiphasic Personality Inventory) (Tables 1, 2).

Table 1. Characteristic of the men’s program (Period and the times of interventions)

<i>Youth team (meal/men) Team program</i>	
Period	Mar.- Nov. (2018 season)
Interventions	7 times
<i>Schedule: Longitudinal intervention among 2018 season</i>	
Date	Contents
Mar. 29	Self-leadership development program I ~VII <Characteristic of the program> 1) The Self-leadership development program based on OD methods, had the theoretical background of the Transactional Analysis—focused on human relations 2) This program was composed of specialized tools such as TPI (Todai Personality Inventory) based on MMPI (Minnesota Multiphasic Personality Inventory)
Apr. 22	
May. 2	
Jul. 8	
Aug. 7	
Nov. 11	

Note. Responses to these questionnaires collected from the participants before and after the intervention of this program.

Table 2. Characteristic of the women’s program (Period and the times of interventions)

<i>Youth team (femeal/wemen) Team program</i>		
Period	Sep.–Nov. (2018 season)	
Interventions	2 times (2 days)	
<i>Schedule: Self-leadership development program (Team building Training) for two days</i>		
First day (Sep. 2)		
Time	Contents	Purpose
10:00	1. Introductions	Description of the program
	2. Tool I	The discovery of learning styles
	3. Tool II	Self-introduction
12:00	Lunch time break	
	4. Tool III (Feedback on TPI)	Explanation of TPI data (PAC /GAD /CON)
	5. Individual work	Summary of the things that I noticed from the advice sheet
16:30	6. Summary	Day 1 Summary + Create action plan
Second day (Nov. 17)		
Time	Contents	Purpose
10:00	7. Tool IV	Group discussions based on the consensus
	8. Group discussions	Mutual consideration of the action plan
12:00	Lunch time break	
	8. Group discussions (Continuation)	Mutual consideration of the action plan (Continuation)
16:30	Summary	Summarize the two days

Note. Responses to these questionnaires collected from the participants before and after the intervention of this program.

2.3 Measures

We used Sport Self-management Skill scale [11], the Belief in Cooperation Scale [12] and Collective Efficacy Questionnaire for Sports [13] to examine the effects of this program from a perspective. Responses to these questionnaires collected from the participants before and after the intervention of this program.

2.4 Analysis

To compare with each score of pre and post, we carried out paired *t*-test and correlation analysis using statistical analysis software (IBM SPSS statistics 24) of IBM Corp.

3 Results

The paired *t*-test showed that the score of some subscales were higher than before the experience of the program (Tables 3, 4). Then, the score of Sport Self-management Skill, Belief in Cooperation and Collective Efficacy improves by this program. In particular, in the men’s team, subscales of Sport Self-management Skill (Thinking, Self-recognition, Sincere attitude, Continuous Initiatives, Achievement effort, Improvement of issues, Inventive ingenuity) were improves after intervention this program. Furthermore, in the women’s team, “Continuous Initiatives” was improves after intervention this program. The Belief in Cooperation changed only in the women’s team after the intervention. Moreover, the scores of collective efficacy were improved on almost all subscales among men’s and women’s team (The men’s team excludes “preparation”. The women’s team excludes “persistence”).

In this study, we examined the relationship (correlation) of each scale after intervention. As a result, positive correlation was confirmed between the scales after the intervention (Tables 5, 6).

Table 3. The result of paired *t*-test in men’s team

	Pre		Post		Paired <i>t</i> -test					
	M	SD	M	SD	Pre-Post	SD	95% CI	<i>t</i>	<i>p</i>	
<i>Self-management skill</i>										
F1: Contribution to the team	4.80	0.25	4.85	0.26	-0.04	0.32	-0.16	0.07	-0.80	<i>n.s.</i>
F2: Thinking	3.99	0.49	4.44	0.57	-0.43	0.66	-0.66	-0.20	-3.78	**
F3: Self-recognition	4.48	0.43	4.62	0.45	-0.14	0.58	-0.34	0.06	-1.40	<i>n.s.</i>
F4: Sincere attitude	4.68	0.45	4.70	0.44	-0.03	0.46	-0.19	0.13	-0.38	<i>n.s.</i>
F5: Continuous Initiatives	3.62	0.72	3.66	0.89	-0.09	0.81	-0.38	0.21	-0.60	<i>n.s.</i>
F6: Achievement effort	4.55	0.45	4.68	0.59	-0.12	0.46	-0.28	0.04	-1.50	<i>n.s.</i>
F7: Improvement of issues	4.48	0.43	4.75	0.38	-0.26	0.51	-0.44	-0.09	-3.02	**
F8: Inventive ingenuity	4.47	0.43	4.74	0.37	-0.27	0.46	-0.43	-0.11	-3.43	**
Total	140.06	9.61	145.84	10.05	-5.68	10.00	-9.35	-2.01	-3.16	**

(continued)

Table 3. (continued)

	Pre		Post		Paired <i>t</i> -test					
	M	SD	M	SD	Pre-Post	SD	95% CI	<i>t</i>	<i>p</i>	
<i>Belief in cooperation</i>										
F1: Usefulness of cooperation	4.66	0.32	4.75	0.36	-0.08	0.41	-0.23	0.06	-1.14	<i>n.s.</i>
F2: Individual-oriented	2.90	0.67	2.62	0.85	0.27	0.80	-0.01	0.54	1.94	<i>n.s.</i>
F3: Reciprocity concern	1.74	0.67	1.63	0.76	0.05	0.82	-0.24	0.33	0.34	<i>n.s.</i>
<i>Collective efficacy</i>										
F1: Ability	4.24	0.53	4.77	0.31	-0.51	0.54	-0.70	-0.33	-5.52	**
F2: Effort	4.59	0.38	4.80	0.33	-0.20	0.43	-0.35	-0.05	-2.69	*
F3: Persistence	4.34	0.57	4.79	0.31	-0.32	0.41	-0.46	-0.17	-4.45	**
F4: Preparation	4.70	0.34	4.82	0.27	-0.11	0.32	-0.22	0.01	-1.88	<i>n.s.</i>
F5: Unity	4.52	0.39	4.79	0.33	-0.26	0.47	-0.43	-0.10	-3.29	**
Total	89.53	6.94	95.94	5.51	-4.48	5.90	-6.58	-2.39	-4.37	**

***p* < .01 **p* < .05

Table 4. The result of paired *t*-test in women's team

	Pre		Post		Paired <i>t</i> -test					
	M	SD	M	SD	Pre-Post	SD	95% CI	<i>t</i>	<i>p</i>	
<i>Sport self-management skill</i>										
F1: Contribution to the team	4.26	0.54	4.41	0.58	-0.07	0.46	-0.27	0.12	-0.78	<i>n. s.</i>
F2: Thinking	3.42	0.65	3.56	0.75	-0.06	0.56	-0.30	0.17	-0.55	<i>n. s.</i>
F3: Self-recognition	4.11	0.56	4.11	0.59	0.01	0.49	-0.20	0.22	0.10	<i>n. s.</i>
F4: Sincere attitude	4.31	0.47	4.51	0.58	-0.13	0.41	-0.30	0.05	-1.49	<i>n. s.</i>
F5: Continuous Initiatives	3.31	0.65	3.42	0.67	-0.13	0.63	-0.39	0.14	-0.97	
F6: Achievement effort	4.11	0.53	4.34	0.64	-0.23	0.48	-0.43	-0.03	-2.32	<i>n s</i>
F7: Improvement of issues	4.15	0.55	4.32	0.57	-0.08	0.45	-0.27	0.11	-0.91	<i>n.s.</i>
F8: Inventive ingenuity	4.06	0.49	4.17	0.58	-0.05	0.56	-0.29	0.18	-0.46	<i>n.s.</i>
Total	126.96	14.53	131.38	15.14	-2.96	9.99	-7.18	1.26	-1.45	**
<i>Belief in cooperation</i>										
F1: Usefulness of cooperation	4.39	0.42	4.53	0.46	-0.09	0.37	-0.25	0.07	-1.16	**
F2: Individual-oriented	2.73	0.56	2.70	0.65	0.06	0.53	-0.17	0.28	0.51	**
F3: Reciprocity concern	2.05	0.69	2.03	0.94	0.00	0.90	-0.38	0.38	0.00	<i>n.s.</i>
<i>Collective efficacy</i>										
F1: Ability	3.06	0.52	3.46	0.58	-0.36	0.53	-0.59	-0.14	-3.36	**
F2: Effort	3.53	0.69	3.85	0.75	-0.26	0.61	-0.52	0.00	-2.08	*
F3: Persistence	3.51	0.66	3.79	0.62	0.01	0.42	-0.17	0.19	0.13	<i>n.s.</i>
F4: Preparation	3.80	0.66	4.17	0.64	-0.27	0.54	-0.50	-0.04	-2.47	*
F5: Unity	3.70	0.67	4.04	0.56	-0.27	0.53	-0.49	-0.05	-2.52	*
Total	70.37	11.07	77.25	10.92	-5.54	7.83	-8.85	-2.24	-3.47	**

***p* < .01 **p* < .05

Table 5. The result of correlation analysis after intervention in men's team

Sport self-management skill	Collective Efficacy					
	F1: Ability	F2: Effort	F3: Persistence	F4: Preparation	F5: Unity	Total
F1: Contribution to the team	.624**	.681**	.431*	.741**	.870**	.755**
F2: Thinking	.543**	.408*	.389*	.456**	.519**	.521**
F3: Self-recognition	.574**	.616**	.514**	.696**	.613**	.676**
F4: Sincere attitude	.465**	.526**	.414*	.501**	.622**	.573**
F5: Continuous Initiatives	0.017	-0.087	0.046	0.024	-0.020	-0.006
F6: Achievement effort	0.277	0.270	0.295	.396*	.347*	.355*
F7: Improvement of issues	.676**	.816**	.707**	.844**	.775**	.859**
F8: Inventive ingenuity	.705**	.635**	.674**	.774**	.776**	.801**
Total	.626**	.583**	.562**	.714**	.718**	.722**

**p < .01 *p < .05

Table 6. The result of correlation analysis after intervention in women's team

Sport self-management skill	Collective efficacy					
	F1: Ability	F2: Effort	F3: Persistence	F4: Preparation	F5: Unity	Total
F1: Contribution to the team	0.134	0.262	0.171	.497*	.440*	0.346
F2: Thinking	0.181	.422*	0.282	.591**	.548**	.469*
F3: Self-recognition	0.142	.489*	0.271	.594**	.504*	.468*
F4: Sincere attitude	.407*	.456*	0.358	.604**	.586**	.554**
F5: Continuous initiatives	0.032	0.013	-0.083	-0.168	-0.012	-0.050
F6: Achievement effort	0.252	0.233	0.052	.462*	0.321	0.304
F7: Improvement of issues	0.299	0.397	0.271	.681**	.511*	.498*
F8: Inventive ingenuity	0.151	0.379	0.186	.581**	.447*	.406*
Total	0.257	.429*	0.242	.618**	.542**	.483*

**p < .01 *p < .05

4 Discussions and Conclusions

This study, carried out Self-leadership development program to elite soccer team, was to compare the scores of each factor in the intervention before and immediately after the program. As a result, it observed that tends to increase the score of several factors after the intervention. These results suggested that Self-Leadership, Sport Self-management Skill and Collective efficacy improves by this program. We would like to

try to guess about why the difference in the score before and after the intervention. The characteristic of the program, which was adopted in this study is to obtain the “new awareness” for the environment (self, others, and organization) in a short time. Therefore, image exchange is widely used in the program to promote mutual understanding and interactions of the participants.

From the previous research, positive correlation was recognized between sports self-management skills and group cohesion and group efficacy [11], and it is pointed out that excellent competition performance can be a predictor of performance [6, 8, 18–20]. And, it has been reported, in order to lead the practical and dynamic process of Team building to success, core components to consider in building a successful team include having a shared vision and unity of purpose, collaborative and synergistic teamwork, individual and mutual accountability, an identity as a team, a positive team culture and cohesive group atmosphere, open and honest communication processes, peer helping and social support, and trust at all levels [21, 22]. These results are considered to support the effectiveness of the program in this study.

Based on the above, it was suggested that the introduction of this program could be an opportunity for the self-leadership development and team building (organization development) for youth athletes. Therefore, the results of this study, it can be said to be an important discovery from the viewpoints of both practical and academic.

5 Future Work

The result of this study just compared with before and after the intervention of the program. That had not compared to the control groups. In the future, it is necessary to longitudinal research and compared with the control groups to examine the effects.

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References

1. Barnard, C.I.: *The Functions of the Executive*. Harvard University Press (1938)
2. Japan Football Association (HP). http://www.jfa.jp/youth_development/outline/
3. Japan Professional Soccer League (HP). <https://www.jleague.jp/aboutj/academy/>
4. Erikson, E.H.: *Identity and the Life Cycle*. International Universities Press (1959)
5. Bandura, A.: Self-efficacy: toward a unifying theory of behavioral change. *Psychol. Rev.* **84** (2), 191–215 (1977)
6. Myers, N.D., Feltz, D.L., Short, S.E.: Collective efficacy and team performance: a longitudinal study of collegiate football teams. *Group Dyn, Theory, Res., Pract.* **8**(2), 126–138 (2004)
7. Wu, J.B., Tsui, A.S., Kinicki, A.J.: Consequences of differentiated leadership in groups. *Acad. Manag. J.* **53**(1), 90–106 (2010)
8. George, T.R., Feltz, D.L.: Motivation in sport from a collective efficacy perspective. *Int. J. Sport. Psychol.* **26**, 98–116 (1995)

9. Hodges, L., Carron, A.V.: Collective efficacy and group performance. *Int. J. Sport. Psychol.* **23**, 48–59 (1992)
10. Watson, C.B., Chemers, M.M., Preiser, N.: Collective efficacy: a multilevel analysis. *Pers. Soc. Psychol. Bull.* **27**(8), 1057–1068 (2001)
11. Takemura, R., et al.: Self-management for student athletes in sports groups: development of a sport self-management skill scale. *Japan J. Phys. Educ. Hlth. Sport Sci.* **58**, 483–503 (2013)
12. Nagahama, F., et al.: Development of a scale to measure belief in cooperation. *Jpn. J. Educ. Psychol.* **57**(1), 24–37 (2009)
13. Short, S.E., Sullivan, P., Feltz, D.L.: Development and preliminary validation of the collective efficacy questionnaire for sports. *Meas. Phys. Educ. Exerc. Sci.* **9**(3), 181–202 (2005)
14. French, W.L., Bell, C.H.: *Organization Development: Behavioral Science Interventions for Organization Improvement*. Prentice-Hall, Englewood Cliffs (1973)
15. Yasuyuki, H., et al.: A longitudinal study on the effects of team building for university baseball team in Japan: from the view point of team-vitalization. *Work: J. Prev. Assess. Rehabil.* **41**(1), 5762–5763 (2012)
16. Yasuyuki, H., et al.: Effects of organizational development on the psychological aspects among university students. In: *International Conference for the 40th Anniversary of Human Ergology Society Program and Abstracts*, pp. 39–40 (2010)
17. Toshima, Y.: The study of mean-level stability of personality traits in adult males over a ten-year period-based on Todai Personality Inventory. *J. Bus. Nihon Univ.* **83**(4), 1–75 (2014)
18. Carron, A.V.: Cohesiveness in sport groups: interpretations and considerations. *J. Sport Psychol.* **4**(2), 123–138 (1982)
19. Carron, A.V., et al.: Cohesion and performance in sport: a meta analysis. *J. Sport Exerc. Psychol.* **24**(2), 168–188 (2002)
20. Kozub, S., McDonnell, J.: Exploring the relationship between cohesion and collective efficacy in rugby teams. *J. Sport Behav.* **23**(2), 120–129 (2000)
21. Yukelson, D.: Principles of effective team building interventions in sport: a direct services approach at Penn State University. *J. Appl. Sport Psychol.* **9**(1), 73–96 (1997)
22. Salas, E., et al.: The effect of team building on performance: an integration. *Small Group Res.* **30**(3), 309–329 (1999)

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