Contributions to Management Science

Kesra Nermend
Małgorzata Łatuszyńska
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Decision-Making in Management

Methods and Behavioral Tools

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Contributions to Management Science

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Kesra Nermend • Małgorzata Łatuszyńska
Eleftherios Thalassinos
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Editors
Kesra Nermend
Institute of Management
University of Szczecin
Szczecin, Poland

Małgorzata Łatuszyńska
Institute of Management
University of Szczecin
Szczecin, Poland

Eleftherios Thalassinos
Department of Maritime Studies
University of Piraeus
Piraeus, Greece

ISSN 1431-1941 ISSN 2197-716X (electronic)
Contributions to Management Science
ISBN 978-3-030-67019-1 ISBN 978-3-030-67020-7 (eBook)
https://doi.org/10.1007/978-3-030-67020-7

This Springer imprint is published by the registered company Springer Nature Switzerland AG
The registered company address is: Gewerbestrasse 11, 6330 Cham, Switzerland

Preface

Making important business decisions is usually a difficult and complicated task. Some decisions concern problems at the macro level, where the participation of decision makers is relatively small (selection of diagnostic variables, expert judgment). These are situations related, for example, to the analysis of complex socio-economic issues described by many features (indicators). In other cases, the decision maker's participation is more important because decisions reflect subjective preferences. In the era of new challenges of the modern economy and the necessity to solve more and more complex decision-making problems, it is important to know and be able to use methods and techniques that support decision-making in practice. An equally important issue in this context is the knowledge of methods, techniques, and tools of behavioral data (both declarative and, for example, related to psycho-physiological measurements).

The monograph will present solutions in the field of problems and methods of supporting decision-making, modern data acquisition techniques, and practical aspects of decision-making. In particular, it will address such important issues as business decision-making, multi-criteria decision analysis (MCDA), multidimensional comparative analysis (MCA), decision games, and data acquisition techniques for decision-making (declarative techniques and cognitive neuroscience techniques).

The book is divided into three parts:

Part I. Theoretical Aspects of Decision-Making in Management consisting of Chaps. 1 and 2. Chapter 1 presents the theoretical aspects of strategic management by describing the variables of external and internal contexts and the risk as the elements that influence decision-making. Chapter 2 demonstrates the characteristic traits of contemporary consumers' rational behavior in the light of the development of economic psychology and behavioral economics.

Part II. Methods and Behavioral Tools in Decision-Making consisting of Chaps. 3–9.

Chapter 3 defines the needs of companies in terms of environmental information and indicates the possibility of using management accounting tools as a source of management information within the environmental management accounting.

Chapter 4 investigates how and to what extent different types of endogenous and exogenous variables influence the performance of Universal Banks (UBs) and the possibility of forming mixed models of decision-making regarding their efficiency and their profitability by using modern analytical tools and operational research methods such as Monte Carlo simulation and Genetic Algorithms.

Chapter 5 considers pension funds as not sufficiently auto financed and the main objective is to develop a tool that allows predicting the appropriate moments to carry out the management interventions with the respective amounts to finance the gaps. It proposes a time homogeneous diffusion process with finite expected time till the ruin. A financial tool that regenerates the diffusion is also admitted, at some level with positive value every time it hits a barrier at the origin. Then the financing effort may be modeled as a renewal-reward process if the regeneration level is kept constant.

Chapter 6 shows how the results of a research in the so-called neuroscience, including epigenetics, contribute to social problems for people belonging to marginalized groups. To achieve the goal formulated in this sense, it describes marginalized communities and discusses the current methods of their activation.

Chapter 7 investigates the problem of nonperforming loans as well as methods to manage in a synthetic and holistic approach by analyzing the subject from the point of view of business administration, accounting, finance, and financial engineering, while banking is only involved in the issues of securitization. To quantitatively investigate the problem, econometric tools and advanced methods of business research were used. For the purpose of the research, real data were used provided by companies and by the banking system in the case of securitization of nonperforming loans, while generalized case studies have been also created.

Chapter 8 measures the emotional and cognitive consumers' responses during interaction with marketing stimuli. It presents some considerations about the employment of neuroscientific tools in real environments for measuring the brain and emotional activity during the consumers' decision-making activities in different contexts of consumption and choice.

Chapter 9 presents a method to determine the value of nonmarket goods by considering them as free time activity not traded in the market. A free time activity is a specific nonmarket good which has its value, which should also be subject to valuation constituting the basis for decision-making on its use. The chapter analyzes the methods of valuation of nonmarket goods in terms of the possibility of their use in the valuation of free time.

Part III. Practical Issues: Case Studies consisting of Chaps. 10–19.

Chapter 10 is a case study of social workers used as a determinant of the effectiveness of decision-making behaviors of the members of an organization (company). Operating in a specific, but changing, environment, fulfilling its role in given situational conditions, it is a very important element of the decision-making process the ability to react quickly and to be ready for change. The study presents the preliminary comments and results of the research carried out with the "Questionnaire of Readiness to Change" among social workers presenting them in seven subscales.

Chapter 11 is a case study analyzing the consumer's perception of engagement in different facets of CSR. The results showed that Polish consumers expect the firms' engagement, though they rarely expect CSR to be a whole philosophy of conducting business. Consumers also expect more engagement in marketplace and workplace facets. The results showed that only the environmental engagement significantly increased purchase intentions. It concludes claiming that consumers demand engagement on more basic level (marketplace, workplace) as something obligatory; therefore, in order to enhance the purchase intentions, companies must show some additional engagement, for example, environment or society related.

Chapter 12 is also a case study to verify whether portfolio investments in companies declaring the use of CSR can be effective. The chapter aims to indicate whether the use of information on the use of CSR by companies may be effective in making long-term investment decisions. For this reason, a portfolio of securities for companies included in the RESPECT index was built, and its effectiveness was presented in comparison to the portfolio built using the classic approach. The conducted study answers the question of whether portfolio investments in companies declaring the use of CSR can be beneficial and whether focusing only on companies of this type can be an alternative to building a securities portfolio because it is important for the horizontal diversification of risk.

Chapter 13 as a case study examines the effectiveness of CG in financial services firms in seven small EU countries (Cyprus, Malta, Luxembourg, Lithuania, Slovenia, Latvia, and Estonia). The objective is to uncover the factors that drive effective CG to explain what drives board behavior. The study revealed that the BODs' Effectiveness Measure (BEM) increased with the academic level of the directors and the number of Boards on which Board members are approved.

Chapter 14 analyzes the effectiveness of electronic public procurements by applying a holistic approach and analysis to the framework that governs electronic public procurements. This is a subject that has not been investigated to a large extent yet, and especially when it comes to the situation in Greece, no relevant study could be found until recently, in spite of the particular importance of the issue to the Greek economy, as well as the Greek public sector. It is found that electronic public procurements are characterized by higher transparency compared to previous years and contribute to enabling access to new markets.

Chapter 15 case investigates the Lithuanian Higher Education Institutions regarding its efficiency on the technology transfer. Technology transfer process performance is measured using data envelopment analysis (DEA), constructed by the input-output principle. The model was designed from seven Lithuanian HEIs with three inputs, international research projects, contracted research, and number of research works, and three outputs, research staff in full-time equivalent, the number of PhD students involved, and the number of master students involved. Research results confirm that DEA tool is fully applicable to evaluate the TT process performance of HEIs.

Chapter 16 presents the effect of incentives, personal needs, behavior of the employees on employees' productivity, job satisfaction, and commitment. A case study has been carried out with employees of a private bank to reveal which

incentives influence two main attitudes: job commitment and job satisfaction. The aim is to find out ways which will help Human Resource Management as well as determinants that describe the alternative ways to improve working performance.

Chapter 17 is a case study on the role of employee diversity, inclusion, and development for socially responsible management strategies. The research configures several aggregated pillars and management strategies that need to be accounted by companies to enhance environmental, social, and governance (ESG) achievements with benefit spillovers on the financial performance and firm profitability. Four basic ESG pillars (gender diversity, inclusion, people development, and controversies) are the core elements used.

Chapter 18 case study presents an enterprise risk management (ERM) maturity index for European airports. Airports can improve their capabilities to anticipate, manage, and possibly turn risks into opportunities. The purpose of this study is to investigate and identify the best practices that represent ERM maturity in the business context of a European airport and to develop an ERM Maturity Index as a resource to assess and evaluate their ERM implementation. Results show senior management commitment, an optimum communication process, and well-defined ERM roles and responsibilities. These are the three most crucial factors for airports to achieve a high degree of ERM maturity.

Chapter 19 case study is a comparison between Poland and Belgium regarding the relation of pro-ecological attitudes and behavior. Polish and Belgian consumers differ in respect of pro-ecological attitudes and behaviors. On the level of declarations, Polish consumers claim to be more concerned about ecology, but Belgian consumers behave in an ecologically responsible manner more often. Moreover, pro-ecological attitudes are more prevalent among women than men as well as among people with a higher education; however, this effect can only be seen among Polish customers.

Although the subject of this monograph, Decision-Making in Management, has an extended literature, the issues presented light the subject from a different perspective. They cover three different aspects of the subject (Theoretical Aspects of Decision-Making in Management, Methods and Behavioral Tools in Decision-Making, Practical Issues: Case Studies) in a holistic way with views coming from different authors. Of course, there are more to study in this subject and in the opinion of the editors, it shows well the diversity of areas, problems, methods, techniques, and domains concerning this subject.

Szczecin, Poland — Kesra Nermend
Szczecin, Poland — Małgorzata Łatuszyńska
Piraeus, Greece — Eleftherios Thalassinos

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The original version of this book was revised. The correction to this book is available at: https://doi.org/10.1007/978-3-030-67020-7_20

Part I
Theoretical Aspects of Decision Making in Management

Theoretical Aspects of the Strategic Management Decision-Making of Companies

Nervo Jonpiere Apolo-Vivanco, Jesús López-Rodríguez, and Jorge Guido Sotomayor-Pereira

Abstract This chapter analyses theoretical aspects of decision making within the strategic management process in companies. To make decisions it is necessary to analyse the problem from the knowledge and understanding of it; problems do not always have similar conditions and there are risks involved in a mechanical response or an intuitive approach. In the business context, the consequences of a bad or good choice can have repercussions on the success or failure of the organization. Good decisions are not easily achieved, they are the result of an arduous and orderly methodological process. Robbins and Coulter (2018) propose, for example, four perspectives on the way managers make decisions: rationality, limited rationality, intuition, and evidence-based management. The study of decision-making has long been of interest by numerous researchers.

There are countless variables on which decision-making depends, among which we have the external context, the internal context, risk, mental models, behaviour, risk forecasting and the time of decision-making. According to Hillier and Lieberman (2015) decision making is done based on the choice between some options, an alternative is chosen to solve certain situations that may arise.

Every company, be it micro, small, medium or large, is affected by two types of environment: internal and external. Robbins and Coulter (2018) explain that the internal environment are those forces or factors that directly affect a company (customers, consumers, suppliers, value chain), while the external environment is made up of factors that they operate outside the organization and affect its performance. These factors are associated with economic, political, social, cultural, technological and globalization aspects. In the internal context, the strengths and weaknesses that

N. J. Apolo-Vivanco (✉) · J. G. Sotomayor-Pereira
Grupo de Investigación Global Plus, Facultad de Ciencias Empresariales, Technical University of Machala, Machala, Ecuador
e-mail: napolo@utmachala.edu.ec; jsotomayor@utmachala.edu.ec

J. López-Rodríguez
Grupo Jean Monnet de Competitividade e Desenvolvemento na Unión Europea (C+D), Facultade de Economia e Empresa, Universidade da Coruña, A Coruña, Spain
e-mail: jelopez@udc.es

K. Nermend et al. (eds.), *Decision-Making in Management*, Contributions to Management Science, https://doi.org/10.1007/978-3-030-67020-7_1

companies have and on which the manager makes certain decisions are evaluated. Rodríguez and Pedraja (2009) state that in the external context the threats and opportunities that exist in the environment are analyzed, they also emphasize that the agents who make the decisions do not have all the necessary information to choose between the various options presented, which causes uncertainty when making decisions.

De León (2007) states that risk analysis in decision-making is associated with the continuous improvement that companies seek, by estimating the probability of unwanted events occurring in the process, where to measure the magnitude of the situations that may generate negative impacts that may occur. On the other hand, risk analysis is associated not only with systematically observing the situations that arise in order to make a decision, but also with making methodological proposals that allow determining the causes and consequences of making a decision.

The objective of this work, therefore, is to theoretically describe the variables external context, internal context and risk as elements that influence decision-making, applied mainly to those that are strategic in nature, understanding as a strategy the way in which the resources of a company, prior to the development of a production or administrative process, are deployed.

Keywords Decision-making · Strategic management · Companies · Risk

1 Introduction

Decision-making from the nineteenth and twentieth centuries has gained momentum for its relevance in business environments. However, it is from the 1950s that the decision-making began to deepen (Rodríguez and Pinto 2010). Long standing scholars such as Simon (1947) study the rationality and behavior of the individual to understand the phenomena related to decision making. Cohen et al. (1972) analyzes the stages of rational models for decision-making within companies. Moody (1991) refers to decision making and its use as a tool for daily use in the study of organizations and administration. Huber (1990) defines strategic management as an objective and systematic approach to decision making, describing detailed and simple techniques and explanations. Choo and Díaz (1999) studies decision-making in organizations from the analysis of information that allow knowledge. More recently, others such us Mintzberg (1973) describe a model for making strategic decisions at the senior management level. Demir et al. (2017) analyze the strategic approach in decision-making for the growth of companies. Zhao et al. (2020) analyze the behavior of individuals in the decision-making process in an organization. As a result, studies emerged on managerial decision-making and the market dynamics to which organizations are faced with. During the period of the industrial revolution, an individual administration was carried out. Each owner, based on his intuition, made decisions that had consequences in the production processes and in other cases in

the company labour force. Over the years, businesses began to grow and become more complex, which made managers begin to hire experts in the areas of marketing, law, engineering, finance, among others. At the beginning of the twentieth century, managers made decisions based on internal information and operational statistics of companies. However, these models were unsophisticated in the face of a multitude of factors, both internal and external, related to organizational decision-making and risk involved.

Decision making according to Gigerenzer and Wolfgang (2011), is the selection of alternatives within a myriad of options where the potential results and consequences of adopting an alternative must be considered. In addition, the characteristics of the various options that meet the objectives and needs of the company are evaluated. Elbanna (2006) states that decision-making in companies is not only based on a simple process, rather, it occurs thanks to a significant number of processes and the way in which the decision is applied. This is vital to the success or failure of it. Nutt (1999) agrees with what was previously described and explains that "the tactics used by managers to establish directions, discover options and implement their plans identify the types of processes that are more and less successful" (p. 78).

According to Nutt (1999), "the failure is generally due to events beyond a manager's control: draconian government-imposed regulations, unexpected budget cuts for top management, or loss of market share due to fickle customers" (p. 75). Unlike success, which is the outcome of having carried out the processes adequately and with the participation of most of those involved. Accordingly, "when task force members are assigned an important task, success is more likely. Full participation is rarely used, but leads to decisions that are made in almost all cases." (Nutt 1999, p. 86) suggests the importance of teamwork to increase the options for success. This idea is supported by what Saaty (2008), p. 95) states "group decision-making processes are: how to add individual judgments in a group in a single representative judgment for the whole group and how to build a choice from individual options" . In this sense, 9 years after Nutt (2008) states that teamwork allows to contribute with ideas and intensifies the collection and analysis of information that allow better results. Business success is given by decisions based on quantitative information more than any hunch. However, the decision maker has the last word (Nutt 2008).

In all economies, companies strive to achieve and maintain supremacy, greater participation, greater sales or share of the market. In this context, the efforts of the organizations are focused on making their value chain and their production and administrative processes highly efficient.

However, achieving such results requires joint efforts between all areas of companies, properly defined administrative processes, impeccable human talent management and around all this, decision-making processes that allow solving problems, managing the company and being highly proactive to anticipate market trends.

The purpose of this chapter is to analyse three variables that influence the decision-making process and strategic management of companies: the internal environment, the external environment and risk. We will therefore carry out a theoretical description of these variables and their impact on decision-making. Before doing so, we will describe the methodology used for the development of the research.

Finally, with the results obtained we want to contribute to make them to become a point of reference for companies' managers. This way, managers of the organizations can understand the influence of those three variables on business management and make appropriate decisions. The goal is that these decisions guarantee the achievement of the organizational objectives and therefore the improvement of their productive and competitive level.

2 Methodology

To achieve the objectives of this chapter, which is to analyze three variables: the internal environment, the external environment and risk, the explanatory technique was applied. This technique aims to analyse factors that influence decision-making and strategic management of companies. To carry out this research, a literature review was carried out concerning decision-making. The documental exploratory method was applied, using analytical, interpretive and critical reasoning. We analyzed the literature with rigorous objectivity and the arguments presented here start from our experience in the area and the revised literature on the subject. In short, the applied method allowed, through mainly academic theoretical literature analysis, to reach the goals set for the research agenda carry out in this chapter.

3 Theoretical Background

There are many variables that influence a company and limit the decision making that can be made. Robbins and Coulter (2010), state that the criteria of a manager is influenced by two elements: the culture of the organization and the environment to which he or she is faced with. Organization culture can be understood as the set of values, traditions, customs, ways of doing the things that influence the way people act within a company. Environment's company is made up of forces that affect an organization. Departing from these concepts we are going to find two types of environment: internal and external.

3.1 The Internal Environment

In this sense and following Robbins and Coulter (2010) who explain that the internal environment is made up of factors or forces that directly affect a company. Those factors are the clients, suppliers, consumers and the value chain that the company has. The internal environment is unique for each company. For its part, the external environment is made up of factors or forces that are outside the influence of

a company but that also exert influence on it. These factors are economic, social, political, cultural, technological and globalization factors.

Pulgarín and Rivera (2012) state that one of the main challenges in the field of strategy is the development of tools that allow for a better decision-making process. In this sense, there are a multiplicity of instruments that can be used for this purpose, namely: SWOT analysis, Porter's type of analysis, the disciplines of Treacy and Wieserma (as a continuation of Porter's work), analysis of the product-market matrix of Ansoff, growth-participation matrix analysis, among others. However, whatever the technique is used, it is clear that the environment, be it internal or external, must be controlled so that decisions about planning and strategic decision-making are the most appropriate. Decision makers do not have all the information they need to choose from; they are not able to conceive of all the possibilities for solving a problem, and time is not infinite for decision-making, so strategic decision-making is a fundamental task for decision makers, as it allows organizations to align their resources and capabilities with the threats and opportunities that exist in the environment (Rodríguez and Pedraja, 2009).

The destiny of business organizations is based on decision-making that takes place in an environment of constant change. This is why it is important to analyze the different factors related to the business context, both internal and external. In principle we will focus our attention on the internal environment (Prieto et al. 2018). The managerial activity must not lose sight of the different factors that are included for making important decisions, whose tendency is the search for definitive or simple solutions with minimal possibilities of errors, which lead to the success or failure of the organizations (Leyva et al. 2018).

In organizations, innovation plays an important role. This innovation is managed by the senior management in charge of designing value-generating strategies, thus seeking to develop distinctive competencies in products and processes (Landazury et al. 2018). Technology and science are also key elements for economic development which together with the traceability of knowledge used, generate greater performance in organizations (Melamed and Miranda 2016).

The uncertainty, volatility and complexity in the organizations makes the execution of good administration essential. This is a key element as this area is the most relevant and vulnerable of any institution. Therefore, everything that involves good administration is based on learning and knowledge, so senior managers must possess skills, abilities, good attitude, leadership and experience, to better perform the activities under their responsibility (Canelones & Fuentes, 2015).

Therefore, human capital predominates as an element that accelerates or delays change processes and the benefits that originate from them. However, the responsibility does not fall exclusively on the collaborators since they are guided under a leadership of the structural levels, strategic and tactical. Here it is the importance of senior managers in charge of generating corporate strategies and clear and inspiring strategic direction (Fontodrona and Sison 2017).

Within a business environment, the most successful and outstanding companies have been those that have been directed and created by competent, effective, trained

and above all qualified people with managerial skills that must be possessed for the development of administrative activities in the role of a manager (López et al. 2019).

Based on what has been previously described, managerial capacities are fundamental axes for the internal and external management of an organization. These capacities have to do with conceptual, technical and human knowledge and skills that allow for effectively and efficiently administrative management. Conceptual capabilities allow for a better analysis of the internal and external environment as a whole leading to better decisions. Technical capabilities refer to experience and knowledge on the handling of machines, equipment or tools and processes. Finally, human capabilities allow for good relationships with other people who belong to the organization.

Taking into account this background for managerial decision-making, it is possible to state that the internal analysis of the organization involves looking within it to identify what are the capacities and resources that represent its weaknesses and strengths (San Emetério, 2014).

Weaknesses are the vulnerability to competition or different threats from the environment. They are the qualities that prevent the mission from being accomplished, deteriorate the influences of organizational success and growth. They can be controlled, minimized or eliminated. Among the weaknesses in an organization are: depreciation of machinery, lack of resources, staff turnover, lack of leadership, waste of raw materials, little diversity of products, choice of unnecessary decisions, insufficient research and development facilities, among others (Ifediora et al. 2014).

Strengths are defined as the qualities that help to fulfill the mission of the organization, and the basis to continue, sustain or achieve success. These can be tangible or intangible. It mainly stands out in the potential advantages of a company compared to competitors, which includes human skills, technology innovation, process capabilities, financial resources, a broad line of products, committed employees, the ability to adapt to different needs, among others (Ifediora et al. 2014).

For internal analysis, the application of the theory of resources and capacities is required, which is one of the contemporary trends and main theoretical models of strategic management. This theory begins in the eighties of the last century (Fong et al. 2017), and emphasizes the importance of internal resources and capacities that organizations control and, in the ability, to generate income streams. In addition, it highlights the efficient combination that arises between resources and capacities to maintain and obtain competitive advantages. Competitive advantages are considered the most precious strengths of organizations, because they are capable of creating consumer value (Teece et al. 1997).

The theory of resources and capabilities is the source of competitive advantage. This can be tangible and intangible and allow for the production of goods and services that result from the integration of human, financial, organizational, social, natural, and technological resources, among others which are linked to the organization. These resources help to develop sustainable capacities and different processes, allowing them to obtain competitive advantages (Fong et al. 2017). Among the important resources that senior managers take into account for decision-making are the following:

Human resource: it is made up of the people who make up the organization (employees, businessmen, investors, manager, etc.), considered as the most valuable resource of an organization. This is because it has, from an intangible perspective, knowledge, experience, capabilities and skills. These aspects are a fundamental factor for the operation of other types of resources, that is, people are considered the first source of resources and capacities (Fong et al. 2017). Managers of the institutions must focus their attention on the human factor to avoid falling into the continuous change of personnel, which affects the economic results of the organization.

Financial resource: constitutes the cash and set of assets that generate liquidity. Among them are the bonds, the contribution of partners, shares, fixed-term deposits, profits, savings as own resources. External resources are private or public credits among others, which allows organizations to stay on their feet and compete in the market. This is a key element that managers take into account when deciding, avoiding reducing the risk of economic losses (Vallejo et al. 2015).

Physical resource, considered as the set of tangible assets that are susceptible and necessary for the development of various activities. Buildings, machinery, automobiles, office equipment, supplies and raw materials, finished products, among others, are also found in this classification, which are also necessary for the organizations to function (Blazquez and Mondino 2012).

Finally, there is the organizational capital, which is also part of the intellectual capital. It consists of intangible resources that create value and are available in the organization, for example, patents, trademarks, intellectual property, reputation, among others, which allows identifying ways to use the resources without creating difficulties for existing strategies (Romero et al. 2013).

In reference to the capacities, these allow the management of the resources, they are the abilities, aptitudes or knowledge coming from the people who make up the organization. They help to restructure, integrate, organize and coordinate the different resources destined to production. Capabilities are intangibles that closely relate people to resources, to take advantage of the fusion of these elements and create a source of competitive advantage. Among the outstanding decision-making capabilities to consider, the following are presented:

Technological capabilities seen as the way organizations adopt, master, use, design, manufacture, and create technologies through knowledge, whether new or existing, to produce process improvements or new products or services. In other words, technological capabilities improve management, production and organization (Hernández 2017).

Organizational capacities which consist of the ability to negotiate or manage resources and capacities, adapting them to the conditions of the environment. It is also considered important collective skills or abilities in the business field, because they generate better results in administration, allowing the organization to create a personality and identity (Dávila 2013).

Finally, there are human capacities, which are the different skills, abilities, knowledge, aptitudes, attitudes to handle situations or business resources (tangible or intangible) that are closely linked to the human capital of the organization (Rivera 2016).

In sum, management decisions based on the internal organizational environment are closely related to managerial capacities and abilities for the analysis of the strengths and weaknesses that a company possesses. For the internal analysis, it is necessary to apply the theory of resources and capacities. This theory allows identifying and knowing better what resources favor the organization, in which they can be improved or eliminated. With regards to capacities, it is necessary to determine how high Managers can enhance the knowledge of human resources to correct, improve or change production processes, organization and business management. Properly combining resources with capabilities allows creating a dynamic organizational team, updated to face organizational and technological changes. It is also important to consider the members of the companies as the first order resource that must be taken care of to avoid a business weakness and create a strength.

3.2 The External Environment

From the second World War on, operations research came into place in the businesses decision-making process. Operations research is a quantitative method that serves as a support tool for the decision-making process. The use of this technique allowed to give a better solution and adopt better decisions that offered empirically created databases. As a result of the twenty-first century, senior managers have developed new strategies, forms or ways of managing based on the development of technology and science. Timely information on processes prevails as a measure for better effectiveness and efficiency in administration (Silvestri et al. 2009).

Currently, the traditional vision changes to a transformative systematic vision that involves teams, technology, and information systems that are a fundamental part of decision-making (Canelones 2015).

Due to the numerous changes, disturbances and dynamism that exist in markets, organizations, societies and cultures, it is essential to seek new strategies oriented to the long term (Cano and García 2018). According to Quispe et al. (2017) the development of the ability to produce and handle information correctly is closely linked to knowledge and communication that form the raw material of the new society.

Knowledge management can be defined as the transformation of intellectual assets and information into a lasting value. In other words, it is also considered the ability of a director or business manager to increase tactical knowledge creating better conditions for exchange of information that encompasses from senior managers to employees (Calvo 2018).

Living in an economy based on information and knowledge, the predominant role has been, in the wake of globalization, increasing the competitiveness of companies by making them act in internationalized environments (Levitt 1983), leading managers to seek new ways of decision-making to compete against companies that have economies of scale. Authors such as Mcfarlan et al. (1983) and Porter and Millar (1986) conclude that information and information technologies become an essential resource to compete among companies (Rodríguez and Pinto 2010).

The development of new technologies has caused a transformation in the way of executing financial, cultural and commercial activities on a global scale. This has caused changes in business organizations to adjust their production processes to new forms of interconnection between markets. Different companies, both small and of large scale located in different parts of the world, are looking for the means to join directly or through network links to the expansion of world trade.

The internationalization and globalization of markets forces different managers or directors to immerse themselves in the new eras of information technology. Most companies face complex and global environments, which are very difficult to interpret. This situation merits a study that allows better management of data for decision-making (Maitland and Sammartino 2015). According to Bernal et al. (2014), the main objective of external analyzes allows senior managers to identify the threats and opportunities to which an organization is exposed.

Based on the threats and opportunities David (1999) and Gómez (2008) mention that these are favorable factors of the environment that can be used to maximize competitiveness in the market, generating new strategies in a timely manner. On the other hand, threats can hinder the achievement of business objectives. For this reason knowing them will allow taking actions that minimize the effects or risks in companies (Rubio and Fierro 2014).

Trends and different external events that cannot be controlled affect services, products, markets and organization in all parts of the world. For Martínez (2016), among the main external factors that are adjusted for managerial decisions are: social, economic, political, technological factors and competitive factors.

The economic factors (García and Pulgar 2010) refer to the current state of an economy, which is related to variables such as inflation rate, unemployment trends, interest rates, exchange rate, income, price level of the products, tariffs, GDP, changes in demand for certain products or services, etc. These economic factors are the main ones to consider for organizations when making decisions, the same ones that can significantly harm or benefit the future of the organization (Noman et al. 2015).

In the social sphere, the variables birth rate, number of births, interest groups, and culture are considered as the main determining elements in decision-making. The social factor is a basic element for economic progress due to the high degree of importance that it has as a factor of structuring of society. In the globalized world, companies not only seek to expand into more countries, but also social networks grow with them. There is an ever greater link between companies and society because the same actor participates in both elements: the people (Sanchéz 2015).

In the political sphere, the factors to be taken into account are the laws and regulations that shape a society, causing in many cases limitations for the operations of organizations. Therefore managers, become in many cases as opportunities and in others as threats. Among the political, legal and governmental variables are changes in fiscal laws, international relations, changes in fiscal and monetary policy, special laws, regulations around exports and imports, special tariffs, the oil and currency world market, among others (Martínez 2016).

Technological factors play a fundamental role, because an organization that does not join the new digital age could not compete with other companies. Different discoveries and technological changes have a drastic result in organizations. Valencias et al. (2012) state that technological forces relate companies to essential activities to start new knowledge and transform it into products, processes and information. Technological advances are of great help to create new markets, new and better products. Organizations that are booming today have taken advantage of technological opportunities to create sustainable competitive advantages in the markets (Gutierrez et al. 2018).

The external factors mentioned make up a dynamic field of intrinsic elements that are related causing reactions, changes, instability etc. that result in complexity and uncertainty. Under this perspective it is better understood through the contingent theory and the resource dependency theory. The contingent theory is attributed to Fred Fiedler, it refers to the existence of both internal and external factors in an organization that act as elements in the organizational design and in the behavior of variables and processes (Zapata and Mirabal 2015).

Managers who manage to adapt and adjust to contingency factors such as environment, technology, economy, strategy, company size and institutional framework are prone to efficiency and longer survival in the markets. This theory affirms that the degree of understanding and perception of the uncertainty of the environment by those who run the organizations leads to better results due to the increased attention on organizational processes, structures and strategies (Ogunsiji and Akanbi 2013; Parnell et al. 2012).

The resource dependency theory is attributed to researchers Pfeffer and Salancik who published a book in 1978 on the external control of organizations (Rueda and Zapata 2018). They maintain that organizations do not possess the capacity and are not self-sufficient to manage all the resources and services that are necessary for their maintenance, survival and growth. As a result, they must turn to resources in their environment (intangible and tangible), which allows them to generate long-term stability and success for the organization. That is, manage variables in the external environment to survive and therefore be effective in the environment of work (Moynihan et al. 2014).

This theory is also taken as a strategy for managers to use stable supply relationships, using tactics to create centralized hierarchical systems of power. That is, through maximizing their power to create cooperative alliances with other organizations. What the theory of resource dependency also means is that many companies establish agreements and they associate with the purpose of surviving to create power and control of the market (Rueda and Zapata 2018).

The theories of contingency and dependence on resources give senior managers an adaptation vision. Therefore, they maintain that the different changes, processes, structure, behaviors, stability in organizations, are explained and depend on the factors of the external environment. Based on this, managers or administrators design negotiation strategies with the different agents in their environment, seeking the exchange of resources, agreements and negotiations, turning them into active agents of organizational survival.

Senior managers have in their power agents of change and transformation that direct organizations or companies through new paths, objectives, processes, strategies, technologies and in other cases towards new risks. Managers are the main characters for decision-making, they use techniques or tools that allow them to get the most benefit, many of them through leadership skills, organizational culture, incentives and division of labour. The specialization provides the reins for the personnel which they are in charge of follow the same objectives (Bravo et al. 2018).

Based on the preceding theoretical review, contingent theory and resource dependency theory that focus on the external environment and the different economic, social, political and technological factors in which organizations operate, allow the manager to make decisions such as create strategic alliances, negotiate agreements, introduce or withdraw a service or product, among other decisions, just to name a few. All this together with the technological tools, human resources, databases, information, leadership, capacities and knowledge become a set of inputs and resources essential for managerial decision-making, whose purposes are to maximize wealth and increase in the market share of companies.

4 Risk as an Element that Influences Decision Making

Decisions regarding risk acceptability and risk treatment may be based on operational, technical, financial, legal, social, humanitarian or other criteria. This often depends on the internal policies, goals and objectives of the organization and the interests of other stakeholders (Australiano 1999, p. 11).

Administrators need to make some decisions in the face of great uncertainty. Decisions are difficult to implement, because their results are unpredictable. The result depends on factors that are beyond the control of administrators, however, the weight of the results falls on who manages the organization (Hillier and Liberman, 2015). Decision making under risk has been a permanent concern of the business sector, "when new companies chase unexplored waters with the intention of achieving substantial growth and above-average performance, risk is an inescapable reality" (Busenitz 1999, p. 326). On the other hand (Willows et al. 2003), mention that "the decision maker will have to be aware of important differences between the public perception of risk and the results of any risk". For many researchers, the risk is strictly contextual and the use of empirical information that provides probabilities of occurrence of various events is essential. However, the knowledge provided by the information and the biases that may arise when making decisions cannot be ignored; In this way, senior managers take risks according to the context, derived from the theory of choice that associates risk with the expected value, taking into account the behavior of managerial decision makers (March and Shapira (1987).

Fischhoff et al. (1978) analyze risk from the perception of individuals of not being successful, that is, the fear of executing the decision. For Busenitz (1999), increasing knowledge in companies reduces the risk when making decisions, emphasizing that companies must train their personnel. For Willows et al. (2003)

low-risk decisions depend on those responsible for making them, and are associated with the results and the probability of obtaining benefit or harm. Similarly, Slovic et al. (2005) state that taking a risk depends on the characteristics of the individuals who influence when making a decision and the uncertainty of not having the desired benefit. In the last decade authors such as Li and Zhou (2011) have analyzed the problem of low-risk decision, indicating that it depends on the personality of the decision-maker in organizations. Under the same circumstances the position of individuals can be different which leads to making different types of decisions. Something similar is stated by Ceschi et al. (2019), the risk is induced by emotional processing. People tend to evaluate the possible results and for this reason when the probability of success is high, individuals are more likely to take risk. These authors agree that decision-making depends on bias or heuristics, and that when applying these elements, it is potentially advantageous for companies.

Heuristics and bias, for Mousavi and Gigerenzer (2014) are tools that are developed over time. When a problem is confusing and uncertain it requires precise solutions and heuristic strategies are used to help managers make decisions derived from human reasoning. According to (Busenitz 1999), entrepreneurs have reasonable doubts when making decisions due to the perception of risk, but they frequently use this fear to take ideas that contribute to the growth of the company. Busenitz (1999) states that "without policies and procedures in force, people must use their own decision-making rules or heuristics to guide their decision-making". For this reason, managers can face uncertainty by making quick decisions, without taking fully into account the risk involved in doing so. On the other hand, McNamara and Bromiley (1999) analyze the need to measure risk by the decision maker. According to these authors, the perceptions of individuals are associated with the risk and the return that can be obtained. Accordingly, "the relationship between the expected risk and the expected return must be positive" (McNamara and Bromiley, 1999, p. 335). However, it does not always happen, because there can be a negative relationship between these two factors, mainly due to an erroneous heuristic perception by individuals.

De León (2007) establishes that risk analysis in decision-making is associated with the continuous improvement that companies seek by estimating on the one hand the probability of unwanted events occur in the process and on the other measuring the magnitude of situations that can generate negative impacts. Moreover, the risk analysis is associated not only with the systematic observation of the situations that arise to make a decision, but also with the taking of methodological proposals that allow determining the causes and consequences of making a decision. "Those who most easily use biases and heuristics can use them to make sense of an uncertain situation by applying their own decision rules" (Busenitz 1999, p. 329).

For Rubinstein (1988) the choice under risk denotes the behavior of individuals against the utility expected to be obtained when making a decision. However, for Cokely and Kelley (2009) decision-making is done not only taking into account the expected value, but also, the priority of increasing knowledge. Making a decision under risk is associated with information processing as they tend to be imprecise. Companies carefully analyze the probability that the risk assumed is minimal. That

is, "for a given level of profit, a higher risk is tolerated if that risk is voluntary, immediate, precisely known, controllable, and lower" (Fischhoff et al. 1978, p. 143). Risk in decision making is linked to the knowledge and intuition of the decision maker, while taking into account the uncertainty and risk aversion generated by the search for better business opportunities.

The risk associated with uncertainty is associated with the predictions that can be found from an empirical model (Gómez and Bosque 2004). Currently, more important than analyzing uncertainty or developing strategies to reduce it, is the fact of having innumerable information about the problem that allows decision-makers to take the risks that are closest to success. Thus, uncertainty implies fear and is reflected in the indecision to assume a situation. This increases the effects caused by individuals' attitude towards risk (Heilman et al. 2010). The uncertainty of the managers causes the approach of different strategies that could develop diverse impulses of decision in the person in charge. In addition, it is a factor that affects the behavior of individuals when making a decision, that undoubtedly limits the operation of companies, becoming an element closely related to risk. In this sense, Willows et al. (2003) define risk as the probability of occurrence of events, associate risk with uncertainty, this affects probability and consequences, increasing the possibility of failure when making decisions.

This vision of uncertainty under risk is general. Busenitz (1999) mentions that uncertainty is present at all times in the business environment. A large amount of uncertainty increases the feeling of risk in decision makers, since it is difficult to calculate the level of involvement of the decision, whether it is positive or negative. For this reason, managers "who most easily use biases and heuristics can use them to make sense of an uncertain situation by applying their own decision rules" (Busenitz 1999, p. 329). In this sense, the large amount of uncertainty does not allow quick and efficient decisions to be made without taking risk into account, which makes bias and heuristics essential in the business process.

Another risk factor is the business climate. Willows et al. (2003) state that "the result of the decisions taken to reduce climate impacts, or exploit climate-dependent opportunities, is one more source of uncertainty" (p. 43). Therefore, risk assessment and uncertainty analysis are tools that allow the decision maker to understand the real situation of the problem within organizations. However, the results are not always obtained since these factors depend on the analyst's subjective judgment, which often uses additional information that cannot be demonstrated if they are correct or wrong (Aven and Zio 2011).

Risk aversion is derived from the maximization of expected utility. However, for (Rabin and Thaler 2001) the aversion in most cases depends on the decision maker's presumption of risk. Thus, the probability of generating benefits not only depends on the marginal utility function. According to Diamond and Stiglitz (1973), the greater the risk, the greater the aversion. Individuals choose a variable that allows solving the choice problem and achieving sufficient scenarios so that the effect of a greater risk aversion on the choice is decisive when make a decision.

The different natural definitions of increased risk aversion are equivalent and lend themselves to an analysis of behavioral differences as a result of differences in

risk aversion, either between individuals or as a result of a parameter change for a given individual (Diamond and Stiglitz 1973, p. 13).

When the expected profit decreases, people avoid unnecessary risks, and even more so when the uncertainty is greater than the certainty of succeeding. One of the behaviors of risk aversion can be analyzed from the idea that the expected return is equal to 0, which causes the decision maker not to risk (Francischetti et al. 2014). This coincides with what is stated by Holt and Laury (2002). For these authors, risk aversion increases while the benefits are higher. Companies invest due to the effect of incentives and the degree of risk aversion is measured according to the behavior of the environment. On the other hand, Kimball (1993) divides risk aversion into standard (assuming a risk suggests that assuming another is less probable, even if they are independent) and absolute (the decrease in profit increases the perception of risk). In this way, "If every risk that has a negative interaction with a small reduction in wealth also has a negative interaction with any undesirable and independent risk" (Kimball 1993, p. 589).

We believe that managers assume risk taking, depending on the biases that appear and on the heuristics that they can use to resolve difficulties. The concepts studied from the literature emphasize that the risk that decision makers perceive is linked to her intuition, although undoubtedly having a large amount of information and extensive knowledge of the problems would help to minimize the risk of failure.

5 Discussion

Today's markets are constantly changing as a result of globalization, changes that force managers of all levels to possess a set of skills, abilities and capacities for decision-making. The present work focuses attention on the internal environment as an element that influences decision-making. Identifying that both physical, human and financial resources play an important role in conjunction with technological, organizational and human capacities is of vital importance. Focusing on theoretical models of strategic management, this chapter highlights the efficient combination that arises between resources and capacities to maintain and obtain competitive advantages, considering the strengths of organizations.

As a result of internationalization and globalization, financial, cultural, commercial and technological transformations on a global scale force business organizations to adjust to these changes and to the new forms of interconnection between markets. Based on this context, our study analyzes the external environment as an element that influences decision-making. When companies face highly changing, complex and global environments, their interpretation becomes difficult. Management decisions from external analysis allow senior managers to identify the threats and opportunities to which an organization is exposed. The first one refers to the difficulties to meet business objectives and the second to the favorable environmental factors.

The results of this study allow us to appreciate the radical importance of the decision-making process for the development of a company. Now, given the nature of the research, the insights of this work can be deepened in future research. However, from the above, the objectives set at the beginning are fully met because we analyze in depth and rigor the environment, internal and external, and risk as factors influencing a manager's ability to make decisions.

From this perspective, this research facilitates the identification of ways by which various forces that affect the functioning of an organization can be controlled. In this way it is possbile to adopt policies, strategies and decisions that minimize the impact of those and enable the constant search for competitive advantages and therefore business success.

This work contributes to increase the theoretical foundations that facilitate understanding the decision-making process from the perspective of the variables studied. Therefore, our analysis describes a set of elements that must be considered when deciding aspects of a strategic and operational nature in a company.

Based on what has been discussed in the preceding lines, it is clear that the quality of a company's decisions goes through the in-depth analysis of a series of variables, within which the environment and risk play a gravitating role. However, we believe that the theoretical evidence presented in this work can be complemented by future research that provides the corresponding empirical evidence.

We must be aware that decision-making is a complex process that integrates a wide set of variables and that differs depending on the context in which it is adopted. However, there are common characteristics to this process:

- Constant search for information to make better decisions
- In-depth evaluation of the elements and variables that make up the process
- Broad discussion of alternatives
- Decision-making by consensus
- Adequate selection of the best alternative
- Monitoring of changes in the context where the company develops

Although the elements indicated above seem easy to work with, they constitute very complex elements when making decisions in an organization. This is due to the diversity of opinions, level of rationality and existing forms of thought.

6 Conclusions

Organizations have been affected by different forces of change, be it internationalization or globalization, causing significant transformations in decision-making processes. To better understand these phenomena, the need arises to develop new concepts or theories that respond to these changes, since traditional methods become unable to provide adequate structures to solve new problems. Thus, the contingent theory and the resource dependency theory focus clearly on the study of the external business context. Therefore the need arises to understand the external forces that

influence managerial decision-making. These factors exert influence in two ways: they generate opportunities and threats. Opportunities are favorable factors that help maximize competitiveness, and threats create delays in business processes and objectives. Among the different external factors are social, political, economic, competitive and technological factors. All of these together form a dynamic field of uncertainty and complexity, becoming key elements that senior managers take into account in making their decisions. These decisions are based on knowledge, capacities, experience, technology, human resources, database, links with expansion networks, leadership skills and organizational culture. Moreover, techniques or tools that allow them to obtain the greatest benefit while minimizing the effects of risks are also taking into consideration.

In the same sense, every manager who wishes to make correct decisions must try to maintain control of the forces or factors that affect his internal environment. In other words, the monitoring and management of a company's suppliers, customers, consumers and value chain will allow its managers to make decisions that will improve their competitive position. On the contrary, if a manager does not maintain correct control of those forces, it is most likely that his decisions are wrong and lead to the loss of market power or reduction of his margins of sales and profits. In short, the analysis of the internal environment will allow identifying the strengths and weaknesses of the organization. Strengths are identified to make a company more robust, while weaknesses are eliminated through administrative management processes.

Although there is no doubt that risk perceptions depend on the results obtained from empirical measurement methods, a manager's decision to take risk is ultimately based on the intuition that the manager warns of a problem. In other words, decision-makers rely more on their knowledge and experience than on some results, even more when these are not enough to ensure that they are not wrong. If managers carefully analyze all the risks involved in making a decision, they could devise strategies that can create competitive advantages to deal with problems. For these reasons, we must insist that bias and heuristics offer a lot of help to explain why managers use their intuition to reach certain conclusions. For future research, it would be convenient to analyze intuition as a determining factor for business decision makers. Theoretical contributions are a great tool to solve problems in almost all business areas. They clear up doubts or strengthen certainties, which are presented by discrepancies or analogies between the different authors, becoming a guide to develop activities in practice. However, when it comes to making decisions, the last word is the decision-maker who usually trusts his knowledge and the risk that the solution of a problem may present.

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Rational Consumer Market Behavior: Selected Theoretical Aspects

Katarzyna Włodarczyk

Abstract The objective of the presented chapter is to demonstrate characteristic traits of contemporary consumers' rational behavior in the light of the trend of changes in such activities, resulting from the development of economic psychology and behavioral economics. The chapter presents selected theoretical aspects of rational consumer market behavior, such as: considerations about needs as the basis consumers' market actions, the nature of the concept consumer market behavior and historical and contemporary perspectives of rationality in consumer behavior. Rational consumer activities force them to make certain calculations. For that reason attempts are made at specifying the criteria and measures of rationality of such behavior.

Keywords Consumer behavior · Consumption · Rationality · Decision making

1 Introduction

Global economic development and social changes, the increase in the standard of living, production development and innovativeness, as well as the emergence of new goods and services on the market as a result of civilization and cultural transformations are accompanied by consumers' behavioral patterns and the decisions. Current studies on consumer behavior demonstrate the complexity of those phenomena and they are the focus of studies in many scientific disciplines, inter alia in: economics, sociology, psychology, or medicine.

It is assumed that the actions taken by a consumer are based on the rationality principle. Hence a question emerges whether the principle is always respected? The objective of the presented chapter is to demonstrate characteristic traits of contemporary consumers' rational behavior in the light of the trend of changes in such activities, resulting from the development of economic psychology and behavioral economics. Information about rational behavior of consumers is very important for

K. Włodarczyk (✉)
University of Szczecin, Szczecin, Poland
e-mail: katarzyna.wlodarczyk@usz.edu.pl

K. Nermend et al. (eds.), *Decision-Making in Management*, Contributions to Management Science, https://doi.org/10.1007/978-3-030-67020-7_2

decision-making of organizations (in marketing management, creating product image, shaping relations with consumers etc.).

The theories of consumer consumption and behavior, including the ones that to a greater or larger extent affect the degrees of rationality, have been developing over the course of centuries. These phenomena have been the focus of interest and have been written about since the antiquity. The evidence of that can be found in the works of: Aristotle, Herodotus, or Plato. In the Middle Ages not much attention was devoted to a consumer, but in later ages the phenomenon became the focus of attention once more. In his fundamental work, A. Smith describes consumption, frugality, the human nature's inclination for exchange and trade as well as the strive for prosperity. His views were shared and continued in the works of D. Ricardo and J.C.L. Simonde. J.S. Mill writes in a similar manner on the activities and decisions taken by people. A particular significance was assigned to consumption by J.B. Say and T.R. Malthus, or C.H. Saint—Simon in their considerations (Malthus 1925; Ricardo 1957; Saint-Simon 1968; Say 1960; Simonde de Sismondi 1955; Smith 2007; Stankiewicz 2000).

However, a substantial increase of interest in the issues of consumption in economics dates back to the late nineteenth century. The development of the scientific concepts on this subject matter can be observed until this day.

The theory of expected utility presented in the 1940s by J. Neuman and O. Morgenstern was a significant theory in the analysis of the rationality principle. The theory assumed that people recognize alternatives of their behavior and the consequences of their choice between such alternatives on the basis of probability and conditions. In order to take an optimal decision, they require knowledge to eliminate mistakes and errors, and to that aim they use the processes of learning and interactions with the immediate and distant surroundings (Potocki 2012).

The following views can be listed, inter alia, as examples of the twentieth century theories of consumption containing elements of rationality: the views of M. Friedman, H.A. Simon, G.S. Becker, or the theses of G. Katona.

M. Friedman assumed that in making a decision a consumer was chiefly guided by an average income that they were able to obtain over the course of their lifetime. At the same time, Friedman's concept emphasized an individual's freedom and individualism and stressed their resourcefulness as well as the ability to judge and maximize benefits (Friedman 1956, 1957; Friedman and Friedman 1994; Krasiński et al. 1984; Stankiewicz 1998).

H.A. Simon based his theory on the thesis of the so-called bounded rationality. He believed that a consumer is not able to recognize all the available alternatives and results of their choices, hence the need to take decisions that satisfy the condition of sufficiency (Simon 1957; March and Simon 1964; Simon 1976; Stankiewicz 2000; Landreth and Colander 2005).[1]

[1] Main books of H.A. Simona: Models of Man (1957), Teoria organizacji (1958, jointly with J. Marchem, Polish edition 1964), Essays on the Structure of Social Science Models (1963), Models of Discovery and Topics in the Methods of Science (1977), Models of Thought (volumes 1–2, 1979–1989).

In turn, G.S. Becker found that consumption constitutes a combination of two elements—a purchased product and the time required for making of a purchase. Simultaneously, the model developed by Becker explained that all the decisions taken by individuals in a family, not only the ones concerning the purchase of goods and services, but also social problems, can be explained in economic terms by applying the costs and benefits account (Becker 1990; Stankiewicz 1998).

Economic psychology, which derived from the concept of psychological behavior developed by G. Katona (1951) in the 1950s, had a powerful impact on the change of how consumer behavior was perceived. According to economic psychology, consumer behavior was of rational nature, i.e., it could be predicted and influenced. However, that behavior did not depend exclusively on prices and income, but also on consumers' perception of economic reality, consumers' expectations and attitudes (Krasiński et al. 1984; Pohorille 1985).

2 Consumer Needs: The Basis for Consumers' Rational Market Actions

Needs constitute a basic factor determining consumer market behavior and choices. A consumer's need is understood as a state of the lack of or a desire for certain goods and services, which at the same time activate the functions of a motive for action, aimed at changing that state (Krasiński et al. 1984).

The variety and number of human needs induces one to undertake attempts at their classification and hierarchizing. In pursuance of various theories, a basic need must be satisfied before any other needs occur. However, further places in the hierarchy depend on the views of a person conducting the systematization. In Table 1 a classification of needs in accordance with selected authors is presented.

The needs classification presented in Table 1 constitutes a part of a widely developed theory dealing with the problems of human aspirations and their satisfaction. An economic entity, when making rational choices, is guided by its own needs hierarchy. A hierarchical structure of an entity's needs and values becomes the result of its psyche and personality. However, this individual system of hierarchical needs is not constant and it changes throughout the course of human life. It depends on biological, social and economic circumstances.

The hierarchies of needs presented in Table 1 at times completely divert from the ones obtained in studies conducted among consumers. It results from, inter alia, the fact that three groups of needs are differentiated in economic sciences, i.e.: production, consumer and other needs (non-economic). Consumer needs are to a larger extend shaped by variable political, economic, social and cultural conditions. Consumer and production needs have the nature of economic needs, since they are satisfied with the goods and services available on the market. On the other hand, the remaining non-economic needs are satisfied through the development of certain attitudes and types of behavior determined in turn by the influence of the

Table 1 Selected classifications of human needs

Author of needs classification	Types of needs in classification
Epicurus (341–270 BC)	Needs: physical and necessary, physical and unnecessary, spiritual.
W. S. Jevons (1835–1882)	Needs: of lower degree, of higher degree.
W.I. Thomas (1863–1947)	Needs: of safety, recognition, friendship, new experiences.
H.A. Murray (1893–1988)	Needs: of safety as a tendency to avoid a psychological trauma from others and in one's own eyes, to humiliate oneself; to perform a feat; to associate, to affiliate; need for aggression; autonomy; compensation; submissiveness; justifying oneself; dominating; expressing one's personality and exhibitionism; feeding and caring; order; play; rejection and isolation; pleasant sensual experiences; sexual need; experiencing care and support; understanding; acquisition; cognition; creation; informing others; experiencing approval and recognition from others; retention.
A. Maslow (1908–1970)	Needs: physiological; of safety; belonging and love; respect; self-realization and transcendence.
B. Malinowski (1884–1942)	Needs: basic (primary), derivative (secondary) and integrative (tertiary).
J. Pieter (1904–1989)	Needs: existential, of freedom, erotic and relative to faith and convictions.
T. Tomaszewski (1910–2000)	Needs: internal, external.
J. Szczepański (1913–2004)	Needs: biological, psychological, social, economic, cultural.
A. Kępiński (1918–1972)	Needs: for oxygen, water, nutrients, sexual needs.
K. Obuchowski (1931–2014)	Needs: self-preservation (physiological and orientation); procreation.
T. Kocowski (1933–1988)	Needs: existential, procreation and development, functional, social, psychic.
J. Kozielecki (1936–2017)	Needs: of safety, independence, affiliation, identity.
F. Oppacher	Needs: of physiological sustenance of life, physical safety, psychological safety, love, belonging, cooperation, self-respect, self-realization and development, purpose and understanding.
K.B. Madsen	Needs as motives: of hunger, thirst, sexual and maternal needs, of defecation, rest and sleep, acquired hunger, activity, security, curiosity, power, social contact, achievements, affiliation, fear and aggression.

Source: Author's own elaboration on the basis of Stankiewicz (2000), Tatarkiewicz (1990), Zalega (2012), Senyszyn (1995), Maslow (1990), Malinowski (1958), Obuchowski (1983), Tomaszewski (1984), Szczepański (1981), Kępiński (1994), Kocowski (1982), Kozielecki (1977), Madsen (1980)

aforementioned conditions. The differentiation and designation of a boundary between consumer and other needs poses some difficulties, since certain relations exist between them.

In the light of this chapter particular attention needs to be paid to consumer needs. There are multiple definitions of a consumer need. Typically it is understood as a need for specific goods and services. One of the definitions of a consumer need is presented by J. O'Shaughnessy. According to that author, a consumer need involves an inclination to use or own a product, but also an inclination to a certain type of behavior. At the same time, the author differentiated two specific types of needs when discussing consumer needs, namely: desire and requirement. The first type—desire—means a need that has not been satisfied; the second type—requirement—is understood as a request or a universal demand for a given type of goods or a service. The views presented by J. O'Shaughnessy are complemented by a claim that consumer needs also involve a desire for functional values resulting from the achieved economic and cultural development (O'Shaughnessy 1994).

A simplified model of consumer needs classification was proposed by A. Hodoly. He differentiated between only two types of consumer needs (Hodoly 1975):

- fundamental ones, guaranteeing the satisfaction of biological requirements, as well as
- higher order ones, constituting a reflection of social and economic conditions in which an individual lives.

Another definition of a consumer need was presented by J. Senyszyn. According to that author a consumer need is a state of necessity to own and/or use products, which triggers an economic activity and which results from the achieved level of development of human environment or their requirements as a biopsychic-social structure (Senyszyn 1995). At the same time, the author assumes that all consumer needs are related exclusively to the product of human work.

The definitions of consumer needs are also accompanied by product classifications with which such needs can be satisfied. M.T. Copeland lists four groups of such products (Altkorn 1995):

- common products, which are frequently purchased and which ensure the satisfaction of fundamental needs;
- elective products, i.e., the ones purchased periodically;
- luxury products—purchased very rarely and enabling the satisfaction of higher order needs, as well as
- completely unnoticed products, which are not included in a household consumption structure, until for them a need arises.

Notwithstanding how many definitions of consumer needs can be found in literature, it is worth noting that every consumer has their own hierarchy of such needs. Based on that hierarchy a consumer makes rational choices and purchases and they thus shape their rational consumption structure. Therefore, a consumer taking a final spending decision constitutes a certain process, which starts long before any eventual choices and purchases of specific goods or service take place.

3 Consumer Market Behavior: The Nature of the Concept

At present, consumer behavior constitutes a broad area of research. Theories on consumer market behavior have chiefly been directed at recognizing the actions of individuals who do not behave in a random fashion, who act under the influence of innate and acquired needs, who take conscious and unconscious actions, frequently under the influence of emotional factors (Dubois 1994; Engel et al. 1995; Fliser 1994; Foxall and Goldsmith 1998; Lambkin et al. 2001; Pinson and Jolibert 2001; Robertson and Kassarijan 1991; Smyczek and Sowa 2005).

The evolution of a scientific approach to the issue of consumer market behavior is presented in Table 2.

There are numerous definitions of consumer behavior in the contemporary literature of the subject, which emphasize various aspects. The economic definitions place a significant emphasis on the need to own goods for the purpose of their consumption, in order to achieve certain usefulness. Goods that become an object of desire arise from consumer preferences, and in turn preferences are determined by a range of products and their availability on the market.

The definitions of "consumer behavior" in economic literature are very similar to one another, and they differ by only slight details. For instance, Schiffman and Kanuk (1994) assume that consumer market behavior constitutes an activity aimed at the satisfaction of needs related to seeking, buying, using and evaluating goods and services. J.C. Mowen (1987) defines consumer behavior as a decision-making process (both by an individual consumer and by a group of consumers), which is comprised of subsequent actions of: purchasing, consuming, having goods and services at one's disposal, gaining experience and formulating opinions. M. Pohorille (1980) presents consumer behavior as choosing goods and services for the purpose of realizing one's needs hierarchy, and then for their use.

In sociology and psychology, when consumer behavior is described, the emphasis is placed on motivation for action, defined as socio-cultural factor or cultural diversity. Thus understood motivation has a different impact on spending motives, obtaining information and decision-making by consumers in various regions of the world (Baudrillard 2006; Mooij 2010; Szczepański 1977).

However, contemporary definitions of consumer behavior most typically have an interdisciplinary nature. They comprise various aspects of consumer market activities, which include: economic aspects (e.g., the process of purchase), social aspects (e.g., individual's behavior in a group) and psychological aspects (e.g., achieving satisfaction). One such interdisciplinary perspectives includes a definition proposed by R. Solomon (2006). It indicates that consumer behavior is a process of choice, purchase, use, acceptance or rejection of products, services, ideas and experiences for the purpose of satisfying needs or desires by an individual or a group.

A similarly broad definition of consumer behavior was proposed by Antonides and van Raaij (2003). According to the authors, consumer behavior may be considered as group or individual behavior, comprising psychological and physical activities along with motives and causes. Furthermore, consumer behavior is evident in

Table 2 Consumer market behavior: selected research trends

Conventional name for a research period on consumer market behavior	Time frame of a research period	Distinctive features
Pre-scientific period	1899–1940	Studies of philosophical and socio-critical nature. Conspicuous consumption as an expression of social position (T. Veblen). Imitation (G. Trade).
Period of research on motivation	1940–1964	Research on consumer motivation (E. Dichter).
Identification of individual categories and concepts	The 1960s	Personality Risk (R.A. Brauer). Cognitive dissonance.
Great theories	1966–1972	Synthesis of knowledge. Great schemes and models: 1965—A.R. Andreasen—general model of consumer behavior when making a decision. 1966—F.M. Nicosia's model (the theory comprises four areas of consumer behavior: mass communication, searching, choice, consumption). 1968—EKB model (authors: J.F. Engel, D.T. Kollat, R.D. Blackwell) and a textbook of Consumer Behavior. 1969—J.A. Howard, J.N. Shet model—the theory of buyer's behavior. 1972—J.F. Hansen—the first European scientific monograph on consumer behavior.
Consumer information processing	Late 1970s	Research on the use of information by consumer and theories of attitudes (J. Jacoby, M. Fisbein, I. Ajzen, J.R. Bettman).
Consumer emotions	The 1980s	Research on the impact of emotions on consumer market behavior (e.g., M. Fishbein, I. Ajzen, G. Zaltman, R.G.M. Pieters, W.F. van Raaij, J.E. Russo, D. Stephens, M.B. Holbrook et al.).
Consumer experience	The 1990s	Research on consumer experience, emotions. Assigning symbolic meanings to consumption. Self-expression through consumption. Consumer typology. Representatives: B. Schmidt, R. Schwer, R. Daneshvary, J. Leight, T. Gebel, R. Rochefort, E. Hirschman, P.A. Albanese, G.R. Foxall, A. Erhenberg, R.E. Goldsmith et al.
Concept categorization	From the 1990s	Consumer mental patterns (regarding products, activities, selves). Concept categorization.
Behavior economics	From the 1990s	Research on information perception by consumers.

(continued)

Table 2 (continued)

Conventional name for a research period on consumer market behavior	Time frame of a research period	Distinctive features
Marketing approach	From the 1990s	Research on after-sales activities of a consumer. Research on consumer loyalty. Representatives: G. Zaltman, W.F. van Raaij, G. Antonides, M.R. Solomon, P.J. Albanese, G.R. Foxall, A, Erhenberg, R.E. Goldsmith, Ch. Moorman, J.M.M. Blomer, H.D.P. Kasper, A. Dick, K. Basu et al.

Source: Author's own elaboration on the basis of: Antonides and van Raaij (2003), Kieżel (2003), Smyczek and Sowa (2005)

the entire cycle of consumption, i.e.: orientation, purchase, use, keeping and disposing of a product. From the broad definition it arises that consumer behavior, irrespectively of the fact whether it occurs with regard to goods and services purchased from the market or public sectors or manufactured within a household, enable a person to use individual or social effects of such behavior and to achieve satisfaction and prosperity.

Considering the scientific attempts at systematizing consumer behavior it needs to be noted that it is a complex procedure of a cyclical nature, comprised of several subsequent stages, such as: feeling needs, assigning priority to them in the hierarchy of needs, obtaining information on available objects of consumption, making a market choice between the available means of consumption and finally using the chosen objects of consumption Mooij 2010; Solomon 2006; Mowen 1987).

In my opinion, one of the most exhaustive definitions of consumer market behavior is the one proposed by M. de Mooij. According to M. de Mooij, consumer behavior is definitely defined as a process of choosing, purchasing, using, managing goods and services, as well as experiencing for the purpose of successful satisfaction of needs and desires (Mooij 2010). In that definition the focus is placed on the elements of contemporary studies on consumer behavior which emphasize the attributes of a person and the process of decision-making (the element of psychology and sociology), management and the possibility of choice (element of management and economics) as well as values and culture (element of culture studies).

4 Rationality of Consumer Behavior: Contemporary Perspective

In this chapter special attention was paid to rational consumer behavior. The perspectives of rationality from the point of view of various sciences are presented in Table 3.

Table 3 Definitions of the concept of "rationality" according to various sciences

The origins of the definition of "rationality"	Defining the concept of "rationality"
Generally accepted contemporary scientific definition	Rationality is a type of behavior that features two conditions: consequence and goal fulfilment.
Philosophy	Rationality means everything that is reasonable, proper, subordinated to a universally accepted goal, such as truth or good.
Psychology	Rational human activities are the ones that meet specific cognitive standards. [or] A state in which we are guided by reason and the will to accept that which is justified.
Economics	Rationality is the activity of someone who in such a way aims to maximize their own usefulness.

Source: Author's own elaboration on the basis of Bullock et al. (1999), Blackburn (2004), Over (2004), Reber and Reber (2005), Zaleśkiewicz (2015), Kwarciński (2014)

The opinions of A. Sen merit attention among various concepts of presenting rationality in the contemporary economic literature. Sen assumes that rationality requires something more than just internal consistency of the choices made within the scope of various sub-sets. It needs to, at least, impose the need for the existence of convincing relations between goals and intentions pondered by an individual and the choices that an individual makes. The problem is not resolved by a terminological procedure described in the basic representation of choices with the concept of "usability" characteristic to a given person, because the procedure does not provide independent data with respect to what such a person intends to do or tries to accomplish (Sen 1990; Zaleśkiewicz 2015). Furthermore, A. Sen emphasizes that a rational human being may maximize their usability, but at the same time not feel and not increase their sense of happiness (Sen 1977).

Using the theories of rationality to analyzing consumer market behavior, it is assumed that the decision-making processes undertaken by a consumer are intended to satisfy their needs and they ought to be rational. Therefore, rational consumer behavior is such behavior that is based on the assumption that an individual strives towards maximum satisfaction with suitable (rational) use of means at their disposal, or an individual fulfils that goal by using a minimum outlay of means or by reaching the greatest efficiency.

T. Zaleśkiewicz presented various concepts of rationality, which also refer to consumer market behavior, dividing them into two basic models: a normative one and a limited rationality model (see: Table 4).

Maximization of usefulness seems to be the fundamental purpose of an individual, also a consumer, behaving rationally on the market. The first factor that forces a consumer to wonder when they take a final and rational decision regarding a purchase is a need, which constitutes a source of the state of dissatisfaction and lack for the consumer, while at the same time it arises from their biological, psychic and social traits. Becoming aware of the cause of the existing situation creates a need for

Table 4 Rationality models (acc. to T. Zaleśkiewicz)

Rationality models	Normative models	**Unlimited rationality** Making optimal choices through an error-free analysis of all the available information
		Optimization subject to limitations Making optimal choices on the basis of the available information (one can omit the information that is currently unavailable)
	Limited rationality models	**Satisfying choice** Choosing between alternatives, and the effects of such choices are satisfying, but they need not be optimal.
		"Short-cut" thinking (simple heuristics) Simple and quick, frequently "short-cut" choices. They provide satisfying, but not necessarily optimal effects.

Source: Author's own elaboration on the basis of Zaleśkiewicz (2015)

market research, obtaining information and planning the purchase of goods or a service that aim to change the state of dissatisfaction of the individual taking decisions. Rational consumer activities force them to make certain calculations. For that reason attempts are made at specifying the criteria and measures of rationality of such behavior. Measures of rationality may refer to both single individuals and to groups (e.g., to members of a household). However, it needs to be remembered that all consumer decisions depend on a multitude of factors. Above all, they depend on such economic factors as: income, prices, savings, credits, the impact of marketing instruments; but also non-economic factors have an influence on spending behavior and final spending decisions, including: demographic, social, and above all psychological factors.

5 Conclusion

People act in order to satisfy their consciously felt desires and they thus try to overcome a state that in their opinion is unsatisfactory. An analysis of individual types of behavior enables their precise recognition and differentiation of features characteristic to consumption, including specific regularities in consumer rational behavior. On the basis of the elements of rational consumer behavior and consumer needs satisfaction presented in this chapter, it seems important not just to develop a series of homogeneous indicators and measures that would enable comparisons and conclusions on consumer rationality, but also to develop a research methodology as well as to systematize the knowledge on the subject, and as a result to conduct comprehensive survey studies using the developed theoretical basis. The continuation of the research on the undertaken subject matter, apart from its importance, is further reinforced by a limited number of comprehensive and current empirical studies in that regard. Therefore, it is worth preparing studies of a continuous nature, which would represent both characteristic individual instances of behavior,

attitudes, which would analyze consumer needs and preferences, and which would also guarantee comprehensive knowledge. It would require an interdisciplinary approach, expressed in the multi-faceted nature of the research. Economic determinants play an important role in shaping rational attitudes, but at the same time the significance of non-economic factors, particularly psychological ones, increases.

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Part II
Methods and Behavioral Tools in Decision-Making

Selected Management Accounting Tools Supporting Companies' Green Decisions in the Context of Environmental Management Accounting

Barbara Kryk

Abstract In the context of the growing expectations and environmental challenges faced by companies, resulting in social responsibility, sustainable development, market competition, and legislation—they take action to rationally manage natural resources and reduce their negative impact on the natural environment. This requires that all stakeholders be provided with relevant environmental information, including information from the accounting system. This information should be processed in such a way as to enable making reasonable and risk-limited decisions. Conscientious management staff know that environmental conditions and activities are closely linked to other aspects of the company's business and can contribute to both its success and failure. For this reason (1) there is growing interest in improving management accounting, in particular environmentally focused accounting, and (2) there is still a need for both methods and tools to help companies assess and make decisions about their environmental activities. The purpose of the chapter, therefore, is to define the needs of companies in terms of environmental information and to indicate the possibility of using management accounting tools as a source of management information within the EMA. The author uses the desk research method and an analysis of the results of interviews with experts as well as deductions and inductions. The results of the performed studies made it possible to identify which management accounting tools would best perform as EMA tools.

Keywords Management accounting tools · Environmental management accounting

B. Kryk (✉)
University of Szczecin, Szczecin, Poland
e-mail: barbara.kryk@usz.edu.pl

K. Nermend et al. (eds.), *Decision-Making in Management*, Contributions to Management Science, https://doi.org/10.1007/978-3-030-67020-7_3

1 Introduction

A company's green activities are now a social imperative. It can be beneficial, especially in the long term, and increase its chances of development. Pro-ecological behavior improves the company's reputation, preserving its image as a socially responsible organization in the public consciousness, which is of great commercial and marketing importance. It is, therefore, necessary to include environmental protection for the purposes of the company's actions. The integration of environmental and economic objectives determines ecological as well as economic success and the decisions that serve the purpose of achieving these objectives require, among others, creating financial and non-financial environmental information that meets the needs of rational management of both the company and the environment (Kryk 2008, 2017; Mastej 2001; Hauff et al. 2012). Creating this system can and should include the use of company accounting, in particular environmentally oriented management accounting, known as environmental management accounting (EMA).

Research carried out in Spain and France shows that companies which, apart from their traditional accounting system, have implemented EMA elements, have reduced the difficulty of obtaining environmental information by 50%. The economic information thus prepared supported the decision-making processes within these units, and not only in the field of environmental protection. The knowledge provided by the additional inclusion of environmental performance in the accounts as well as in the financial environmental information reports was part of competition in the local markets of these units and had an impact on maximizing their profit in the long term (Węgrzyńska 2013). As Szychta (2003) correctly points out, the growing interest in environmental protection and restitution in the context of sustainable development has led to a clear focus on accounting of social responsibility in environmental issues. Environmental accounting concepts with normative theory properties recommend reevaluation of conventional accounting tasks and modifying existing ones or implementing new solutions in the field of financial and management accounting. EMA and the tools developed for its needs meet these recommendations. Therefore, **the purpose** of the chapter is to define the needs of companies in terms of environmental information and to indicate the possibility of using management accounting tools as a source of management information within the EMA. The text **assumes** that the management process in an enterprise requires changes generated, among others, by environmental factors, which creates a need for *ex ante* environmental and non-financial information that can be provided by the EMA through appropriate tools. The layout and content of the paper has been subordinated to the purpose and verification of the thesis. After the author's own research methodology, the essence and tasks of the EMA and the information needs of ecological companies were first presented, then followed by the results of the research performed on selected management accounting tools adopted for the EMA.

The author uses the desk research method (literature studies, analysis of secondary sources) and analysis of the results of interviews with experts as well as deductions and induction.

Added value is the author's definition of the EMA, forming its core tasks and the results of research on the use of management accounting tools to meet information needs in the context of EMA.

1.1 Research Methodology

The choice of research methods and techniques was the result of conceptualization and operationalization processes. The chapter uses the following research methods and techniques: analysis of secondary sources—critical analysis of the literature and the current results of studies; primary quantitative studies—by means of an interview questionnaire; analysis of the phenomenon and synthesis of results; technique of graphical presentation of the results.

In order to indicate which of the management accounting tools would be the best source of management information and/or would best perform their tasks within the EMA, an interview has been carried out with experts specializing in management accounting (with the title of either professor or doctor) employed at four large Polish economic universities and at the same time having experience in business practice. The target group included 30 people.

The study was conducted between June 1, 2020 and June 25, 2020 using the structured interview questionnaire entitled "Management accounting tools and EMA". The questionnaire contained four closed questions with a wide range of answers, wherein three of them contained the last answer (other) with an option to expand the statement. In addition, it was possible to respond individually to the examined issue, an opportunity which was used by some of the respondents. Data was obtained using the PAPI technique[1] and CATI technique.[2] Answers were obtained from 16 respondents, 12 did not respond, claiming that they were "too poorly oriented in environmental issues to provide competent answers", which in itself indicates the need to develop EMA and its tools. Among the respondents who participated, 2/3 were men and 1/3 were women. Due to the relatively small number of respondents, the survey can only be considered as a poll. However, responses obtained from experts are highly ranked, which allows generalizing of the research results.

[1] PAPI—direct individual questionnaire interview.

[2] CATI—computer-assisted telephone interview.

1.2 The Essence and Tasks of EMA

The date of EMA initiation was 1992, when the United States Environmental Protection Agency, US EPA, started the Environmental Accounting Project (Chojnacki 2018). Specific milestones of its development were:

- launch of the project of the Japanese Ministry of Economy, Trade, and Industry (1999), within which publications were issued on guidelines related to the use of EMA (2002—EMA Procedural Workbook, 2007—Guide of Material Flow Cost Accounting);
- publication by the EMA Expert Working Group (cell in the United Sustainable Development Organization/UNDSD) of "Environmental management accounting: policies and linkages" (2001);
- publication of a guide on EMA (International Guidance Document on Environmental Management Accounting) by the International Federation of Accountants (IFAC) (2005).

Environmental management accounting, in general, can be defined as measuring the ecological activity of an enterprise and publishing information on its impact on the natural environment, and thus on society as a whole, and the costs related to it. Such information can be used by management boards both inside and outside the enterprise (for so-called environmental reporting) and, as such, they gain a wider scope than those prepared and transmitted in a traditional way (Kryk 2014a, b).

According to IFAC, environmental management accounting is "*managing environmental and economic activities by developing and introducing appropriate environmental accounting systems and practices. While this may apply to reporting and auditing in some companies, environmental accounting is usually associated with life cycle cost/cost accounting, full cost accounting, and benefit assessment* (i.e. a socio-economic calculation—the author's note) *and strategic planning for environmental management*." (International Guidance … 2005).

In turn, M. Stępień (2008) defines the accounting in question as an "*information and control system, the object of which is the interaction between economy and environment. It is the cognitive segment of business entity accounting, based on the applicable principles of the balance sheet law of a given country and the principles adopted in the management accounting of a given entity. As an accounting subsystem of an enterprise, it creates information on the course and results of the environmental protection process in a given reporting period*".

Bennett and James (1998) refer to EMA as an "*information system enabling the generation, analysis and use of financial and non-financial information in order to optimize both the results of the enterprise's activities in the field of environmental protection and its financial result, the consequence of which is sustainable development*." According to them, EMA covers the following areas that require management decisions:

- energy and natural resource management—tracking and analyzing all energy and material flows necessary for businesses to operate,

- an enterprise's financial management with regard to environmental protection,
- product life cycle testing—identifying environmental consequences caused by a given product or service throughout the entire life cycle, and tracking opportunities for environmental improvements,
- examination of costs generated during the product life cycle—a systematic process of estimating the costs generated in that period by a product or service,
- estimating the company's impact on the environment—a systematic process of identifying all ecological consequences caused by the activities of the enterprise, plant, or specific project,
- monetary valuation of external effects—identification, analysis, and use of information on the external effects of the activities of an enterprise, plant, or specific project.

Considering the above information, it can be stated that EMA is accounting with regard to costs and benefits for the company, and, moreover, for society, resulting from its business and pro-ecological activities presented in a valuable and/or descriptive form. It indicates the place of costs and benefits and the resorts responsible for it. The main task of EMA is to provide financial and non-financial information to the company's internal cells at various levels of management. The basic tasks of EMA in the field of providing environmental information are shown in Fig. 1.

Quantitative and qualitative information disclosed by the EMA should provide practical assistance in making investments and other environmental decisions (e.g. estimating amounts of ecological fees and taxes, planning rational use of environmental resources or manufacturing products/services with regard to the life cycle) as part of the management process. They should, therefore, contribute to the management of the enterprise that will ensure both effective and efficient achievement of business goals with the full use of available resources. Management is increasingly in need of this information because good management also means managing natural resources. This determines the need to modify or develop both management and reporting systems (including the use of appropriate tools) so they can ensure the supply of the currently necessary information. This is not easy, because there are many different potential problems (substantive, methodological, procedural, formal, technical, and organizational), hindering the implementation of solutions in enterprises proposed by the literature. One of the most important facts is that EMA is not regulated by law. Only one element constitutes an exception—environmental reporting according to the GRI (G4) standard in selected types of enterprises (Bednárová et al. 2019; Mućko and Hońko 2013; Mućko 2018) and to some extent is based on data from financial accounting. The frequency of preparation of environmental information is not strictly defined (in addition to selected information submitted to the Provincial Funds for Environmental Protection and the Central Statistical Office). They are generated according to need (ad hoc), and their details vary.

The existing problems and limitations should not slow down the development of the EMA theory, which evolves along with the development of scientific theories and practices of enterprise management, but on the contrary—should provide an

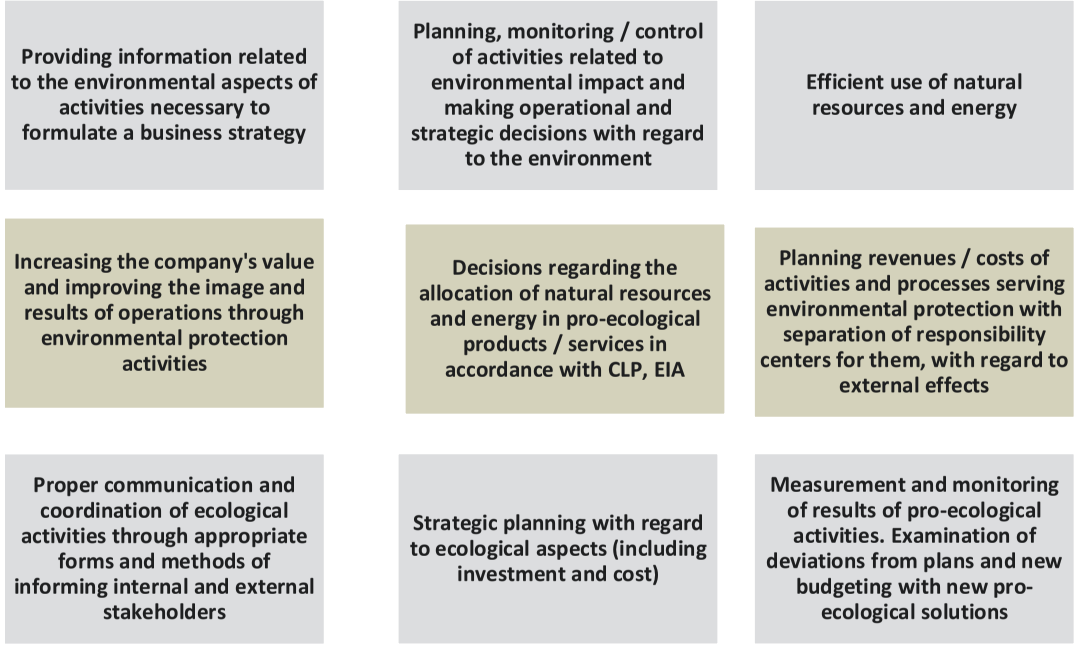

Fig. 1 EMA basic tasks

impulse for its improvement, dissemination, and application of the tools it proposes in practice. This is necessary because the ecological aspects of enterprise functioning are becoming increasingly important in decision-making processes and affect the achievement of goals on all time horizons. Hence, in this article, first the information needs of an ecological enterprise are presented, followed by selected management accounting tools that can be particularly useful in the process of making managerial decisions, with particular emphasis on the aspects of ecological activity of enterprises (in the context of EMA).

1.3 Information Needs of Ecological Enterprises

Ecological information in the enterprise constitutes the basis for creating knowledge of all persons involved in the process of obtaining and using it. They shape ecological awareness about phenomena/processes occurring in the enterprise itself, and its surroundings. They enable the company to adapt to the changing reality (including social expectations, legal requirements, market conditions) and to transform it in order to function efficiently. Thanks to environmental information, the company can visualize existing problems (not only ecological but also economic, organizational) and look for ways to solve them (Zając and Kuraś 2009). This is also the case for environmental information generated by the management accounting subsystem, including EMA.

EMA, due to its optional nature, as well as the ability to include past, present, and future activities in its scope, is much more flexible in relation to the financial accounting subsystem. Therefore, the opportunities to meet the information needs of management accounting tools in relation to environmental issues are large.

In the research conducted by Sadowska (2018) among specialists dealing with accounting in companies, "the interlocutors pointed out that the task of accounting is to support information in the process of enterprise management, and management requires making decisions and introducing changes determined (…) by environmental factors, among others". As a result of the demand of the environment (closer and further) for ecological information, there is a need to generate information on environmental activities/achievements, and financial accounting alone cannot provide such information. In the case of their absence, the information needs of the company and stakeholders are not fully met, which limits the possibilities for making the right management decisions. The emerging uncertainty as to the relevance and rightness of the decision in the conditions of limited environmental information creates the needs of the company and stakeholders in this area (Daft 1992; Majchrzak 2018). Confirmation can be found in the results of Sadowska's research, where 65% of respondents (accountants) indicated that "in the modern world it is not enough to obtain financial information to conduct business" and 50% suggested that "enterprises and stakeholders expect non-financial information: about environmental and social activities."

Information needs mean the desire to have a certain type of information resource regarding the solution for a decision, problem, or the interpretation of specific events (Encyclopedia of Management pdf). Information needs are information required by a given user (including opinions, forecasts, diagnoses, factual data, etc.) necessary to achieve the company's goals, mission, and vision. The impulses creating such needs are changes occurring in the environment at various levels of management. The consequence of this is constant development and modification of information needs.

Information needs of the enterprise of an environmental nature can be met by various tools generating financial and non-financial information. Adamowicz and Szczypa (2014) also Szczypa (2012), conducting research on the possibilities of using management accounting, indicated the following general information needs:

- support for decision-makers with environmental information outside the financial accounting subsystem,
- changes in the procedure of settling indirect costs of the basic activity,
- obtaining more information about non-production activities,
- including non-financial information in management processes,
- information strengthening of preventive and control activities.

We can add the need for more detailed information, among others about:

- the level of target costs, including environmental protection costs, which are the basis for seeking ways to reduce them and plan long-term profits with regard to ecological activities,
- shaping revenues, costs, income, expenses, and other economic categories related to environmental protection, which favors discipline and control in spending the financial resources and observing the time of implementation of production tasks,
- the level of fixed and variable ecological costs,
- the level of product prices, services, resources at competitors, with regard to environmental requirements compared to their own,
- the level of demand for pro-ecological products and services in relation to consumer expectations,
- the volume of production and sales of pro-ecological products and services in relation to the break-even point,
- the company's production capacity, with regard to the costs of negative externalities,
- the amount of environmental protection costs involved in the product's life cycle, useful both for internal management and for environmental management as well as externally to improve its image,
- the impact of environmental protection costs on the level of quality costs of manufactured products, and more generally about the places where quality costs arise and the costs of errors, deficiencies, and lack of prevention in connection with ecological aspects,

- the results of monitoring the implementation of the objectives adopted in the individual environmental protection perspectives (development, financial, customer, internal processes).

In the context of the above considerations about the information needs of enterprises of an ecological nature, it can be said that this type of information is necessary for them in terms of functioning in a changing competitive environment, reporting ever newer information needs. Thinking in future categories about conducting activities that take into account environmental activities, especially in the long term, is not only a theoretical imperative, but is increasingly becoming a practice generating the use of management accounting tools for environmental purposes. Therefore, they are adapted to the needs of environmental management accounting. It should be remembered, however, that due to the costs of obtaining management information, including environmental information, one should focus only on the tools that will meet the environmental information needs to the greatest extent.

1.4 Selected Management Accounting Tools and EMA—Results of Empirical Research

EMA tools provide a way to combine the environmental and economic results of an enterprise and constitute a financial incentive to more consciously consider the aspect of sustainable development of their business. These tools are developed/elaborated because environmental costs have often been overlooked in conventional financial and even management accounting techniques. Meanwhile, as we know, a lack of ecological information leads to incorrect or wrong decision making, which has both environmental and economic consequences for the company. Hence, there is the need to adopt and extend management accounting tools with environmental elements so that they can adequately serve EMA. Thanks to this, it will be possible not only to improve the accuracy/effectiveness of management decisions but also improve the company's environmental and financial performance.

The usefulness of management accounting tools to meet the enterprise's needs for ecological information is determined by its size, method of calculation/accounting, management style, organizational structure, maturity of human capital (in relation to environmental issues—the level of ecological awareness), type of business, and ecological involvement (responsibility for the environment in the context of CSR and the concept of sustainable development). Considering all these criteria to determine the usefulness of management accounting tools for EMA would require conducting extensive research in enterprises for which the author, unfortunately, has no financial resources. Therefore, in order to indicate which of the management accounting tools would be the best source of management information/would best fulfill their tasks within the EMA, interviews with experts in this field were conducted.

Table 1 Strategic management accounting tools most suitable for the use in EMA—respondents' opinion

Specification	Number of respondent answers	Percentage of indications
(a) Target costing	14	87.5
(b) Product life cycle bill of expenses	16	100
(c) Strategic scorecard/Balanced scorecard	14	87.5
(d) Quality cost account	12	75
(e) Benchmarking	4	25
(f) Environmental impact assessment	4	25
(g) Environmental reporting	10	62.5
(h) Other, specify?	–	–

The first question was to indicate which strategic management accounting tools best suit the use in environmental management accounting (Table 1). Respondents to this question could indicate more than one answer and propose other tools than those mentioned. Out of the seven tools, all respondents indicated the product life cycle bill of expenses as the most suitable for EMA, combining internal and external environmental costs incurred during the entire life cycle of a given product together with the sales profit. This was actually to be expected because the account name itself was adopted for the needs of accounting in environmental economics and ecological marketing—developed in connection with the need to implement the concept of sustainable development. This account directly combines economic and ecological costs, hence, its indisputable usefulness for EMA.

Secondly, the most indications were given to (87.5% each) *ex aequo* target cost accounting and a strategic scorecard that can be expanded to include environmental elements, while the least (25% each) was achieved by benchmarking and environmental impact assessment. The last two tools in relation to EMA were more associated with experts' qualitative than quantitative descriptions, which influenced the assessment of their accounting suitability. It also indicates that qualitative data in enterprises are still treated as an "add-on" when making management decisions related to the environment, which confirms the need for education and development in this area.

The second question was to indicate which strategic management accounting tools are best suited for use in environmental management accounting (Table 2). In this question, the respondents could also indicate more than one answer and propose other tools than those listed. Out of the nine tools mentioned above, the majority of respondents (12) indicated activity costing (75% of responses) as the most useful tool for operational management accounting for EMA. This calculation consists of assessing the value of specific activities through the prism of their share in the value of the total annual activity, therefore, with some clarification/effort required, it allows for quite rapid separation and analysis of environmental activities in relation to other activities. This is important from the point of view of costs and work outlays incurred to obtain additional data for making management decisions.

Table 2 Strategic management accounting tools most suitable for use in the EMA—respondents' opinion

Specification		Number of respondent answers	Percentage of indications
(a)	Activity-based costing	12	75
(b)	Budgeting	8	50
(c)	System of indicators for assessing responsibility centers	8	50
(d)	Analysis of the effectiveness of investment projects	2	12.5
(e)	Index Analysis	0	0
(f)	Analysis of financial result deviations	2	12.5
(g)	Cost deviation analysis	4	25
(h)	Price calculation	0	0
(i)	Break-even analysis	0	0
(j)	Other (please specify)	1	6.25

Budgeting and a system of indicators for the assessment of responsibility centers, which were considered a little less usable in the EMA *ex aequo* obtained half of the respondents' indications. This assessment is related to the fact that medium and large companies, rather than small ones, which prevail in the Polish economy, usually use such tools. Therefore, it is hard to expect small companies to popularize the use and development of the functions and scope of these specialist tools on environmental issues. This, however, does not preclude their improvement for the needs of larger enterprises.

The smallest percentage of responses (6.25) concerns the only other proposal provided by one of the respondents. It was a resource and process cost accounting which, as a relatively new management accounting tool, has not yet been combined with the EMA. However, due to its comprehensive nature and providing managers with information on costs and profitability, it can be successfully developed for the needs of the EMA by means of supplementing with environmental aspects.

The respondents were then asked what cost accounts would experts consider implementing in the context of environmental management accounting if they were running a business? In this case, the respondents first listed the activity costing (87.5% of responses), secondly—the product life cycle costing (62.5%), and thirdly *ex aequo*—full cost accounting and target cost accounting (50% each), fourthly, also *ex aequo*—variable costs account and quality costs account (37.5% each). Out of the seven response options, the least respondents, only two, indicated the cost of continuous improvement (12.5% of responses) (Table 3).

Studying the experts' responses (those not only dealing with theory but also practicing accountants) to this question can be treated as a kind of practical suggestion/hint as to which of the commonly known management accounting tools can be relatively easily adapted to the EMA, i.e. the needs of enterprises and their stakeholders for environmental information. It also indicates which tools should be more heavily promoted from an environmental and management point of view at the same

Table 3 What cost accounting would you consider introducing in the context of environmental management accounting if you were running a business?

Specification		Number of responses	Percentage of indications
(a)	Full cost statement	8	50
(b)	Variable costs account	6	37.5
(c)	Activity-based costing	14	87.5
(d)	Target costing	8	50
(e)	Product life cycle bill of expenses	10	62.5
(f)	Continuous improvement costing	2	12.5
(g)	Quality cost account	6	37.5

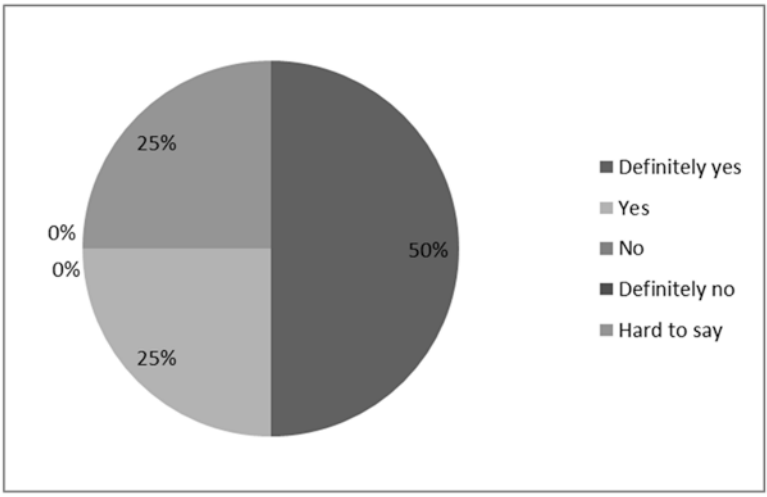

Fig. 2 Usefulness of environmental management accounting tools in the decision-making process (%)

time. This statement finds confirmation in subject literature, among others Kochański (2018).

The fourth question was to comment on the usefulness of environmental management accounting tools in the decision-making process (Fig. 2). In total, 75% of respondents expressed a positive opinion on the usefulness of these tools, which confirms the correctness of their development. The remaining 25% of experts replied, "hard to say". They explained this through the fact that "most micro and small enterprises are still not aware of the importance of pro-ecological activities. In addition, the size of their business and the form of record keeping are not conducive to management accounting. In their case, a viable solution would be to separate the costs associated with measuring costs related to environmental activities; these may be different solutions, e.g. classification of costs by type or referring by type to costs of generation."

In summary, there are a fairly large number of management accounting tools in the subject literature that can help effectively manage environmental costs. Economic realities, however, verify/limit their number to those that can be adapted to the needs and possibilities of enterprises as easily/cheaply as possible. Promoting them could contribute to their dissemination in business practice.

1.5 Conclusions

The issue of environmental management accounting in an enterprise is present both in the subject literature and in business practice, but its scope is more developed in theory than in practice. The considerations made in the chapter lead to the following conclusions:

1. Enterprises are aware of their environmental information needs and the need to use environmental management accounting tools to help them make management decisions. This confirms that EMA and its tools should be developed/improved.
2. According to the respondents' opinions, the most useful tools for strategic management accounting are product life cycle costing, target costing, and strategic scorecard. On the other hand, for operational management accounting tools—activity costing, budgeting, and the system of indicators for assessing responsibility centers. It is, therefore, worth considering methods of making these tools more popular in enterprises.
3. Experts have also suggested increasing the use of certain accounts as they are already used in practice and their development with environmental aspects will not generate excessively high costs of adjusting to the needs of the EMA, or fear of changes (novelty). They listed—according to the order of highest percentage of indications—activity costing, product life cycle costing, full costing, and target costing.
4. An additional confirmation of the usefulness of environmental management accounting tools in the decision-making process is the fact that a total of 75% of experts have opted for them.

Research results and theoretical considerations have also positively verified the assumed thesis and indicated that, as a result of changes in the environment and expectations of stakeholders, enterprises are facing the need to use environmental management accounting tools tailored to their needs.

Acknowledgments The project is financed within the framework of the program of the Minister of Science and Higher Education under the name "Regional Excellence Initiative" in the years 2019–2022, project number 001/RID/2018/19, the amount of financing PLN 10,684,000.00.

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Administrative Accounting Information to Control Profitability Under Certainty and Uncertainty of a Universal Bank

Sotirios Trigkas, Konstantinos Liapis, and Eleftherios Thalassinos

Abstract This chapter investigates how and to what extent, different types of endogenous and exogenous variables influence the performance of Greek Universal Banks (UBs) and the possibility of forming mixed models of decision making regarding the efficiency and profitability of UBs. The approach was carried out through a unified methodology of financial, accounting, and mathematical programming, with the simultaneous use of modern analytical tools and operational research methods such as Monte Carlo simulation and Genetic Algorithms (GAs).

We document that it is possible and effective to structure Financial Statements (FS), with financial analysis, and automation, through the modeling of business plans, the utilization of a comprehensive accounting mathematical programming assessment and modern operational research methods through Monte Carlo simulation for the modeled Balance Sheet (BS) and Income Statement (IS) according to Additional Funds Needed (AFN) methodology. There can also be automation in the processes of banks' budgeting and business plans, under deterministic assumptions of banks' policy variables and even under uncertainty in achieving values for these variables, using operational research techniques and methodologies of GAs.

Moreover, the modelling of FS with the construction of deterministic and stochastic models of banking business plans, is fully compatible with the European Supervisory and Audit Institutions, while simultaneously is friendly and easily applicable by UBs administrations.

The original version of this chapter was revised. The correction to this chapter is available at https://doi.org/10.1007/978-3-030-67020-7_20

S. Trigkas (✉) · K. Liapis
Panteion University of Athens, Athens, Greece
e-mail: S.trigas@panteion.gr; Konstantinos.liapis@panteion.gr

E. Thalassinos
University of Piraeus, Piraeus, Greece

University of Malta, Msida, Malta
e-mail: thalassinos@ersj.eu

K. Nermend et al. (eds.), *Decision-Making in Management*, Contributions to Management Science, https://doi.org/10.1007/978-3-030-67020-7_4

Keywords Administrative accounting · AFN models · Bank performance · Operation research

JEL Classification Codes G21 · M10 · M41 · C44

1 Introduction

For the purposes of the study, accounting techniques as well as various other quantitative techniques where utilized to create original decision-making models for controlling banks' profitability, through the financial, accounting, and mathematical programming methodology while using modern analytical tools and operational research methods such as GAs. The purpose is to enhance the control and measurement of efficiency for the decision-making in management, under the requirements of International Financial Reporting Standards (IFRS).

Initially we made use of financial ratios and timeseries analysis, of 13 yearly accounting data (2004–2016) derived from published FS of four systemic multinational banking groups in Greece and abroad. Further on the study researched the effect of multinational presence and mergers and acquisitions for the same banking groups and during the same period, making use of sectoral data and panel data with multivariate linear regression. Additional research was carried out on the application of liquidity models and the allocation of the resources of a banking company, for the control of efficiency and profitability, through an original and consistent economic and mathematical modeling of a banking company's activity.

AFN models were developed specifically for Greek (GR) UBs and in accordance with the reporting requirements structure of European Central Bank (ECB), European Banking Authority (EBA), and Directorate-General for Competition (DG Comp.) with proforma accounting data of a non-systemic Greek banking group. The AFN banking model was tested as a deterministic model with sensitivity analysis with two historic and three projected periods. Furthermore, the model was stress tested under Monde Carlo simulation. Finally, a GAs methodology was applied to the same model.

All these models can bring together the approaches and findings of the sciences of Accounting, Administrative and Banking Accounting, Mathematical Programming, Banking Science, Mathematics, Financial Engineering, and other quantitative methods such as statistics and economics. The findings of the sciences are complementary and a model of decision-making, but more broadly, the financial modeling of banking company is reasonable only as mixed form.

In detail, a research was carried out on:

- The regulatory and supervisory framework of GR UBs
- The procedures for the preparation of budget, BS, and their control models

- Sensitivity analysis and the use of stochastic methodology in the basic budget assumptions to assist in the preparation, control and planning of BS and IS figures
- The use of econometric methods to aid decision-making
- The use of operational research methods to assist original decision-making models
- The financial analysis of FS, on existing medium-sized bank, in the context of the submission of business plans to EBA and DG Comp which was also an example of good practice.

2 Motives for Choosing the Topic

The motivation for choosing the specific research on controlling the efficiency and profitability of GR UBs can by summarized in three main points:

- In recent years, the subject has significantly occupied the academic community, monetary and supervisory authorities, but also societies, as it significantly affects economic activity at national and international level.
- In most cases it has been done with deterministic models, with a sensitivity analysis of only adverse and favorable scenarios versus the main scenario.
- The use of the traditional methods requires commitment of significant human and material resources, while being also a time-consuming activity.

Therefore, there is a need to control the profitability of GR UBs with modern effective methods under conditions of certainty and uncertainty.

Initially the purpose of the research focused on the investigation of the factors that affect the profitability of a banking company, through time series analysis at national and multinational level and whether the various theories that have been developed for multinational banks have specifically use for the case of GR UBs Groups. Then it went on to test whether it is possible to design a mathematical bank accounting system specifically for planning purposes, as well as to create a forecasting model with the ability to transform it into a control model and a strategic planning model. The objectives set forward where:

- The exploration of the factors affecting the profitability of a banking undertaking
- The development of an original efficiency control model
- The introduction of sensitivity analysis in the model
- The introduction of statistical methods of determination based on historical data of probability distributions for interpretive variables that mainly affect efficiency
- The use of simulation methods to produce the probability distribution for endogenous variables with main variable efficiency when its interpretative variables follow specific probability distributions
- The introduction of modern operational research methods for the controlling of efficiency and profitability of a banking company.

3 Contribution to Acquired Knowledge

The contribution of the research derives from the fact that according to our knowledge, there is no study that includes primary accounting data of the last 13 years before and after the transformation of the Greek banking sector, which, at the same time, with the period to examine the extroversion of GR UBs and the support of their activities abroad during the Greek debt crisis and always in relation to profitability. Also, there is no systematic study on the application of the AFN methodology to a bank FS both under conditions of certainty and under conditions of uncertainty, with deterministic and stochastic processes.

The relevant AFN model has proven to serve extremely well, for the need of both annual planning (budget) and the medium-term (strategic—business planning) under conditions of suffocating lack of liquidity faced by the banking sector in recent years. The scientific research to date does not deal with this problem with completeness and consistently but are fragmentary and focused on parts of a banking firm, such as credit, or stress test of loan and investment portfolios. Most studies approach the bank efficiency and profitability through macroeconomic analysis, not considering the factors affecting the internal process of shaping profitability within the bank, provided by the historical accounting data.

Therefore, the documentation of the originality of this research is extracted directly both through the creation of models and the possibility they provide for quantitative investigation, both under conditions of certainty and uncertainty and with a practical interest, for the banking industry.

4 Main Questions

The main questions that the study answers are:

- Is it possible to form more scientifically modern models of controlling the efficiency of a banking company?
- Can these models gather approaches and findings of the sciences of Accounting, Mathematical Programming, Banking, Financial Engineering, Statistics, Econometrics and Operational Research?
- Can the structure of FS, financial analysis and automation through modelling of business plans for banks, be done through a comprehensive accounting assessment and modern methods of operational research and statistics and apply to the proforma FS of banks on the basis of budgets and business plans?
- How can there be automation in banks' budget and business plans, under deterministic assumptions for the evolution of banks' policy variables?
- What will happen if there is uncertainty about the achievement of target figures for these variables?

5 Literature Review

Between 2000 and 2010, there was an aggressive expansion of domestic European banks to Balkan countries, Turkey, and Egypt. By late 2008, the shares of Southeast European banks owned by foreign investors had surpassed 80% (Claessens et al. 2008). More specifically, between 2004 and 2009, loans from GR UBs to Southeast European countries rose from 17% in 2004 to 57% in 2007 of the total foreign lending (Kapopoulos and Lazaretou 2007). This international presence of GR UBs together with the credit crisis that followed 2010 was the subject of research by Liapis et al. (2018). This was the first such extensive study of the performance of Greek UBs, covering the primary accounting data of the last 13 years before and after the transformation of the Greek banking sector, which, at the same time, with the period to examine the extroversion of GR UBs and the support of their activities abroad during the Greek debt crisis.

Starting with the theories of expansion for the multinational banks and the examination of BS and IS accounts through Time Series Analysis in Greece we note that almost all established theoretical examples are based on the cost-benefit analysis of an investment decision. Regarding cost, Hymer (1960) introduced the widely accepted idea that foreign banks face important cost disadvantages in comparison with local competition (e.g., cultural differences, legal obstacles, control problems). Hence, to be able to profit in a foreign market, international banks must possess the ability to yield profit not available to local competitors.

Expected profits of operating in a foreign financial market generally come from (a) factors related to a competitive advantage, (b) unachievable efficiency by banks solely operating on a local-national level, and (c) diversification of geographical/geopolitical risk.

Concerning (a), state-of-the-art financial products, better mediation techniques, and higher management quality are frequently mentioned in the eclectic theory of multinational companies (Dunning 1988), in the respective study on multinational banks (Gray and Gray 1981), and in the theory of internalization (Buckley and Casson 1976). Another competitive advantage comes from the relationship between the bank and its clients. Capitalizing on special information regarding a client in the country of origin, the bank can follow the client's expansion to foreign markets, based on the existing trust relationship. The phenomenon of "following the client" asserts that banks will expand to countries that their clients invest in, so that they can continue to offer them required services (Brimmer and Dahl 1975; Gray and Gray 1981; Zimmer and McCauley 1991). Supplementary to the aforementioned theory, Grubel (1977) and Grubel and Grubel (1979) hypothesized that this phenomenon can be a defense tactic, since not following the client may mean losing them to a local bank, which in turn may even expand to the client's country of origin and acquire all of their banking business.

Concerning (b), the main factors described in the literature are the size of a bank, its level of internationalization, and its products and services. The importance of size has been analyzed by Tschoegl (1982). The business model that the banks

follow (foreign subsidiaries and retail banking or branches and investment banking market) has been studied by Casson (1990), regarding its use in the transformation of size to profit. The importance of internationalization has been studied by researchers who postulate that banks with a big and geographically diverse clientele can reduce transaction costs. Services and distribution channels can lead to important yields especially in developing economies, where banking services are relatively poor. In the case of subsidiaries oriented in retail banking, it has been argued that they can yield profits through product and service efficiency.

Concerning (c), Aggarwal and Durnford (1989) and Berger and DeYoung (2001) argue that multinational banks diversify their revenue base by operating in foreign countries, gaining profits in relation to the risk-return profile they have chosen.

Other microeconomics/behavioral economics theories focus on the role of strategic behavior. Knickerbocker (1973) argues that when a bank enters a phase of internationalization, local competitors may follow due to the oligopolistic reaction. Concerning the internal (intragroup) capital market, literature suggests that a parent bank may create an internal capital market and transfer funds to and through its subsidiary banks. Thus, an investment in a subsidiary will depend less on the capital it produces and more on the capital of the parent bank (Campello 2002). Jeon et al. (2013) found that by using internal (intragroup) capital markets, multinational banks can shift risk and restructure revenue between parent and foreign subsidiaries or the worldwide network of branches and subsidiaries. They also researched and verified that the role of crisis transmission through the internal (intragroup) capital markets is the same regardless of whether the crisis is positive or negative, because in both cases it affects the dependence of the subsidiary on its own capital and also showed that this role becomes more important over time. De Haas and Van Lelyveld (2010) consider the relation between subsidiary lending and the characteristics of the parent bank, as well as the parent's support to weak subsidiaries, as evidence of the existence of internal (intragroup) capital markets. For purposes of studying the capital flow between parent and subsidiary banks, they also studied features related to capitalization and cash flow, instead of the size and risk (as assessed by rating agencies), because they believe that liquid assets and capital may be used from the parent bank to affect the borrowing of its subsidiaries.

Frey and Kerl (2015) researched for the first time the decision-making process of a subsidiary concerning borrowing, because of the financial composition of the specific subsidiary, other subsidiaries, and the parent bank. They introduced a validated measure of approximate calculation of intragroup flows, by which they could detect competition between foreign subsidiaries for parent-based financing. They also define two subcategories of foreign bank subsidiaries: (a) those which operate only on a local-national level and (b) those that conduct international business, thus operating as lending hubs. They investigated the extent to which banks, during the financial crisis, prioritized financing of the private sector of their country of origin over the financing of foreign bank subsidiaries. In their conclusions, they highlight a trend of parent banks prioritizing the financing of the national private sector over the needs of their subsidiaries abroad, and, consequently, they reveal a competition between subsidiaries that operate on a local level, but no such competition exists

between subsidiary hubs. They also found that subsidiary banks with a good performance in terms of bank deposits depend less on the financial structure and the features of their parent bank and can cover the needs of their loan portfolios almost by themselves. Finally, they state that when a subsidiary bank, showing a good performance, has relative independency regarding its financing needs and when operating in a specific market is of strategic importance for the parent bank, exiting this market will incur an important cost.

The examination of a banking AFN model with sensitivity analysis, in terms of efficiency and determinants, the following grouping is observed in the independent variables: Most studies classify the factors studied into three main categories: (a) Macroeconomic factors (b) Sectoral factors (c) Internal determinants.

At the Macroeconomic Level of the bank's performance measurement we have the stress tests and credit risk models, where Blaschke et al. (2001) cite an example in which the non-performing loan ratio (NPL) is falling against the nominal interest rate, while Van den End et al. (2006) propose an alternative method representing simultaneous changes in macroeconomic variables and their interactions, as typically exists in macroscopic scenarios derived from structural macroeconomic models. Jiménez Zambrano and Mencía González (2007) apply a three-standard-deviation shock to the GDP and interest rate variables; similarly, Castrén et al. (2008) use a five-standard-deviation shock for one macroeconomic variable of the GVAR model. Wong and Hui (2009) describe a model developed at the Hong Kong Monetary Authority to assess liquidity risk and Kapadia et al. (2012) describe the RAMSI model developed by the Bank of England.

At Sectoral and Internal Level, the size of the business affects profitability at a statistically high level, according to the studies of Short (1979), Smirlock (1985), Bourke (1989), Molyneux and Thornton (1992), Akhavein et al. (1997) and Bikker and Hu (2002).

The positive relationship between the level of concentration of the industry and the efficiency and profitability and the better quality of management is completed by Bourke's work. The effect of financial risk (credit risk) on efficiency seems to differ from study to study. In most of these studies, the financial risk is measured based on the impairment index on all loans. The course of this factor changes performance and profitability in the future.

High-risk financing (high-risk loans) leads to higher levels of forecasting and inductively lower levels of efficiency and profitability. In this case, the following procedure was followed by Berger et al. (2000), accepting that the trend of return and profitability seems to continue over time, reflecting elements of sector concentration, sensitivity to macroeconomic disorders, etc. Similar results are found in the studies of Bashir (2003), Davydenko (2010) and Javaid et al. (2011). In contrast, results have been expressed in several studies. The negative and statistically significant relationship between capital and efficiency is supported by Tregenna (2009) others.

We approach the macroeconomic level though basic interest rate set out by ECB, growth rate of GDP and unemployment and price index rate. All above elaborate in

with an analytic framework for a bank's main asset and liabilities classes and their interactions, mixed in the banking AFN model.

Regarding the examination of the AFN model under uncertainty via Monte Carlo simulation with PERT probability distribution function, according to Albright and Winston (2014), Monte Carlos technique or stochastic simulation (due to the presence of random processes) refers to a computerized mathematical technique that provides a range of possible results and chances of their occurrence, taking into account specific input ranges and probabilities. According to Vose (1996) the PERT probability distribution function is named because it uses the same hypothesis for the mean of networks PERT (Program Evaluation and Review Technique) used in project design. Technically, it is a distribution version of Beta and is widely used in risk analysis to model PERT expertise on the uncertainty of a variable.

As far as the examination of the application of Methods of GAs in an AFN banking model, GAs provide an alternative method of resolution. They mimic the Darwinian principles of natural selection, creating an environment where hundreds of possible solutions to a problem can compete and only the "most capable" survive. By studying the relationship between BS and IS accounts with the methodology of GAs we can find an extensive bibliographic survey of Aguilar-Rivera et al. (2015). According to their research, the main areas of study for applications of GAs are:

Abnormal noise and fraud detection (ABN), Arbitrage (ARB), Bankruptcy detection (BKR), Cash management (CM management), Credit portfolios (CP), Credit scoring (CS), Fundamental analysis (FA), Forecasting (FC), Index Tracking (ITR), Market simulation (MKS), Procurement (PRC), Portfolio optimization (PSP), Transactions—Trading (T) and Trading execution (TX).

From the above research topics of GAs, we distinguish and classify the relevant researchers accordingly.

Varetto (1998), Gaspar-Cunha et al. (2014) studied bankruptcy detection (BKR). Da Costa Moraes and Nagano (2014) focused on cash management (CM). Tapia and Coello (2007) and Ponsich et al. (2012) investigate credit portfolios (CP). Huang et al. (2012), studied credit score (CS). Fundamental analysis (FA) was approached by Jiang et al. (2009), Huang et al. (2012), Rimcharoen et al. (2005), Araújo et al. (2006), Parracho et al. (2011), Araújo and Ferreira (2013), Bernardo et al. (2013), Wagner et al. (2007), Hamida et al. (2016), Mahfoud and Mani (1996), del Arco-Calderón et al. (2004), Donate and Cortez (2014). Portfolio optimization (PSP) is another extensive research topic by Gupta et al. (2012), Wagman (2003), Krink and Paterlini (2011), Lwin et al. (2014), García et al. (2014), Adebiyi and Ayo (2015), Ranković et al. (2014).

6 Methodology

For the first objective which was the analysis of FS of Greek systemic banking groups with international presence, for the efficiency testing of theories for multinational presence, in accordance with International Accounting Standards, we proceeded to:

- Analysis of time series based on the IFRS 8 International Financial Reporting Standard "Operational Sectors", which is an evolution of the International Accounting Standard IAS 14 "Provision of financial information by sector".
- Production and analysis of ratios related to IFRS 8 "Operational Sectors", to help draw conclusions on theories about multinational banks.
- Analysis of regression with panel data of historical BS, IS and macroeconomic variables (Crisis—Mergers) performed by aggregate regression analysis of the 48 observations (12 yearly FS of the 4 GR systemic banks) (Least squares in panel data) and pseudo variables of least squares Least Square's Dummy Variables (LSDV).

For the second objective which was the development of an original efficiency control model, we consider that the summary BS of a bank can be described by the following identity:

$$\begin{aligned}&\text{Net Risk Assets} + \text{Net No Risk Assets} = \text{Deposits} + \\ &\text{Financial Liabilities} + \text{Other Liabilities} + \text{Equity Book Value}\end{aligned} \tag{1}$$

Assuming that there are no capital transactions, the AFN methodology presents the economic surplus/deficit created by the bank in each period and is determined by the following expression:

$$\begin{aligned}&\text{AFNt} = \Delta\text{Net Risk Assetst} + \Delta\text{Net No Risk Assetst} - \\ &\Delta\text{Depositst} - \text{Net Incomet} - \Delta\text{Other Liabilitiest} + \text{Dividendt}\end{aligned} \tag{2}$$

A positive value represents the new additional financing required to finance all assets at the end of the period, while a negative value represents the economic surplus generated during the period. The limitation of cash inflows and output outflows with the possibility of future evolution can be defined as:

$$\text{AFNt} = \Delta\text{Financial Liabilitiest} \tag{3}$$

The above first equation expresses a restriction of purely economic balance, which is capable of perfectly matching total assets and total liabilities (Eq. 3).

Relying on the above three equations at first we develop a deterministic model, based on an original structure of the banking AFN Model, with the main Loans, Deposits, Equity and other funding and IS accounts, being constructed in accordance with the bank supervisory authorities reporting standards and with data from historical periods t-1 and t, and forecasting periods t + 1, t + 2 and t + 3 (Eqs. 1–3). The model examination was based on predefined changes in three distinct scenarios:

- a change in the volume of total deposits and loans
- a change in deposit and lending rates
- a change in the internal structure of deposit and loan products.

For the third objective of introduction of sensitivity analysis to the AFN model, we made use of the AFN banking model and of Top Rank software, in order to

conduct a What if sensitivity analysis, so as to observe the factors and the magnitude of the effects that affect profit/loss after taxes from continuing operations for forecasting periods t + 1, t + 2 and t + 3.

Further on for the fourth and the fifth objective we proceeded to the introduction of statistical methods of determination based on historical probability distribution data for the interpretative variables principally affecting profitability. The examination of the deterministic AFN model was studied under conditions of uncertainty using the Monte Carlo methodology and the specialized software @RISK.

Therefore, the study of the behavior of two key variables as outputs for three future periods t+1, t+2, t+3 was selected. The first variable of results is total equity (total equity) and the second variable is that of profit/loss after tax from continuing operations. In order to study the behavior of the above variables results, 9 inputs were selected and studied simultaneously for three periods t+1, t+2, t+3, so we have a total of twenty-seven parameters that affect the two variable outputs under consideration. The input parameters selected as interpretive variables of the model are presented below:

- Administrative Expenses,
- Depreciation
- Fees and Commissions Expenses
- Fees and Commission Income,
- Increase in Deposits
- Increase in Total Loans (before Write offs)
- Other Operating Income
- Staff Expenses
- Loan Write-offs.

Using probability distributions for the interpretative input variables formed with historical data for the needs of the research and their analytical data, we proceeded to Monte Carlo simulation for 50,000 iterations to approach the behavior of the dependent variables of our model.

Finally, for our sixth objective, we chose the introduction of modern methods of operational research to control the profitability of a banking company by the examination of the model using GAs. Regarding the model of GAs for the control of the structure of a banking company, we expressed the problem with the restrictions and the constraints illustrated in Table 1.

The problem is described as follows: The objective function is to maximize profits after tax from continuing operations, by processing 10,000 iterations (repetitions) and at the same time considering certain constraints on loans and deposits and certain restrictions on loans on deposits and loan financing. Total increases in gross loans (before write-offs) can range between 0% and 5% and can be further analyzed according to the product-by-product analysis. E.g. Mortgage between 10% and 22%. Consumer loans between 2% and 5%. Credit cards between 2% and 5%. On the other hand, deposit restrictions are increased between 0% and 5% and can be further broken down according to the product line: E.g. Savings Between 10% and 30%, Sight from 10% to 30%. Finally, the restrictions should relate to loans,

Table 1 Maximization of Profit/Loss with restrictions and constraints of AFN banking model using GAs

GAs problem to be solved			
Objective function	Maximize	Profit / Loss after tax from continuing operations	Product or Balance Sheet line
Restrictions on Loans			
0%	<=	5,00%	Increases of Gross Loans (before write-offs)
10%	<=	20,00%	Mortgage
2%	<=	5,00%	Consumer
2%	<=	5,00%	Credit cards
3%	<=	7,00%	Other
1%	<=	5,00%	Public sector
10%	<=	25,00%	Large Corporate
20%	<=	35,00%	SMEs
15%	<=	30,00%	SBL
Restrictions on Deposits			
0%	<=	5,00%	Increases of Deposits from Customers
10%	<=	30,00%	Savings
10%	<=	30,00%	Sight
40%	<=	70,00%	Term
1%	<=	1,50%	Other
Constraints			
on Loans	=	1 or 100%	All of Gross Loans
on Deposits	=	1 or 100%	All Deposits from Customers
on Funding Loans	<=		Deposits+Equity

deposits, and financing of loans. The sum of all product lines of loans and deposits must be 100%, while the financing of loans must be less than or equal to the sum of deposits and own funds.

7 Main Findings

For the first objective, on the efficiency of banks at national and multinational level, we can observe that the Greek systemic banking groups had a multinational presence mainly in Southeastern European Countries, fact that as we prove played a substantial role regarding the consequences of the Greek debt crisis that followed the financial crisis of 2008 (Table 2; Figs. 1, 2, and 3).

As we can observe almost 25% of the assets was for over 4 years abroad 40% while over 30% of the revenue was from the international operations for over 4 years (2008–2012) (Fig. 1).

Examining performance ratios of Sales on Assets (SOA) and Return on Assets (ROA) we find the following. Regarding SOA from Abroad, we see that for about 10 years (2006–2016) significantly outperforms SOA from Greece (Fig. 2).

Regarding Return on Assets Greece and Abroad (2004–2016), we see that for the 4 years of the Greek debt crisis (2010–2014) ROA Abroad had a steady and positive effect in contrary to the Greek ROA.

Moving forward we examined the consequences of the crisis and the role of Mergers and Acquisitions (M&A) during the crisis. During the crisis there were a

Table 2 Presence of Greek Systemic Banking Groups (by legal entity) in SEE countries until 31/12/2012

	Albania	FYROM	Bulgaria	Romania	Serbia	Ukrania	Cyprus	Total number of SEE countries with Greek Bank presence, by Banking Group
Piraeus Bank	1	0	1	1	1	1	1	6
National Bank of Greece	1	1	1	1	1	0	1	6
Alpha Bank	1	1	0	1	1	0	1	5
Eurobank	0	0	1	1	1	1	1	5
Total number of Greek Banking Group by country	3	2	3	4	4	2	4	

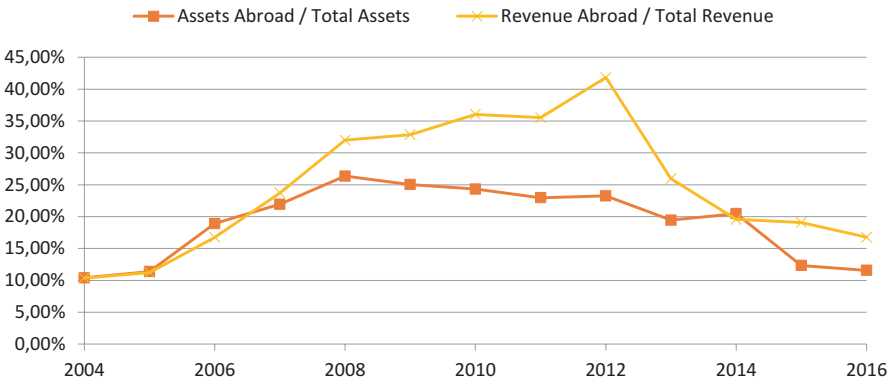

Fig. 1 Total Assets and Revenue of Greek Systemic Banking Groups from Abroad 2004–2016

total of 14 M&A (Table 3). M&A were a strategic option from the Greek Systemic Banking Groups to cope with the growing financial distress of the debt crisis.

We also examine the consequences of debt crisis and M&A by regression of panel data of the four systemic banks for 13 yearly published FS (2004–2016) or 52 observations. The main findings of the research for the efficiency of banks at national and multinational level are that (a) the investments of the four Greek systemic banking groups abroad, it is clear that these investments have proved positive in dealing with negative economic effects within the country of origin, thus confirming one of the theoretical prospects for internationalization of banks, to avoid and spread risk or risk diversification, (b) regarding the impact of the crisis was

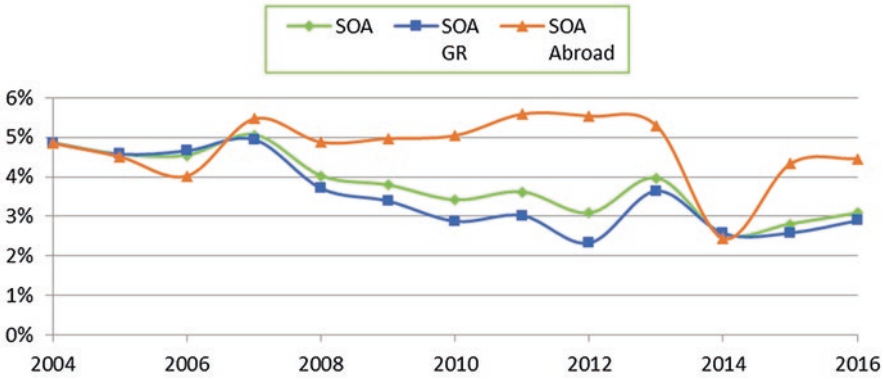

Fig. 2 Sales on Assets in Greece and Abroad (2004–2016)

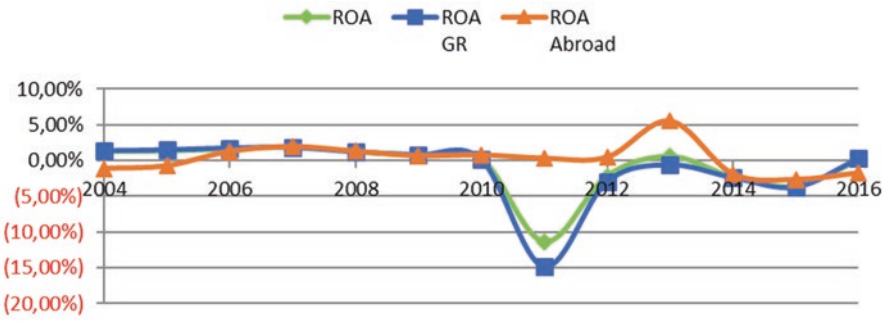

Fig. 3 Return on Assets from Greece and Abroad (2004–2016)

negative for all segments of the Greek Banking Sector, but these were significantly balanced by the positive result caused by mergers and acquisitions in the sector for systemic banks.

Regarding the second objective, as far as the development of an original efficiency control banking model, the modelling of FS with the construction of deterministic and stochastic models of banking business plans, fully compatible with supervisory and audit institutions, ECB EBA DG Comp. and directly understandable and practically applicable by the bank's administrative management team, we can safely support that it was a success as it was accepted both from external and internal users of financial information of the bank. Below we illustrate the various interdependences as well as the iterations for the calculations of an AFN banking model (Fig. 4).

On the third objective of the performance of a What if sensitivity analysis on the deterministic AFN banking model, we document that market activity orientation, commonly the marketplace in which the bank operates most importantly, inevitably plays an important role in shaping its results. As we can see clearly the dominant importance of managing Non-Performing Exposures is obvious, in proportion to the

Table 3 Mergers and Acquisitions from Greek Systemic Banking Groups during debt crisis 2012–2014

Non-systemic GR Banks (targets)	Merged or acquired by systemic Universal Bank	Year of merge or acquisition
Agricultural Bank of Greece	Piraeus Bank	2012
General Bank	Piraeus Bank	2012
Cyprus Bank (GR branches and operations)	Piraeus Bank	2013
Cyprus Popular Bank (GR branches and operations)	Piraeus Bank	2013
Hellenic Bank (GR branches and operations)	Piraeus Bank	2013
Millennium Bank	Piraeus Bank	2013
Panhellenic Corporate Bank	Piraeus Bank	2015
New Proton	Eurobank	2013
Postal Bank	Eurobank	2013
Pro Bank	National Bank of Greece	2013
Commercial Bank	Alpha Bank	2013
Citi Bank (GR branches and operations)	Alpha Bank	2014

part in which the banking company is most active in the market, which is in line with the current crucial problem for GR UBs, which is the effective management of Non-Performing Exposures (Fig. 5).

Also, the consistent way in which dominant variables are ranked high not only in the period for which they are examined in proportion to the IS, but also in terms of future time periods, influencing future IS results, as shown by Liapis and Trigkas (2019) marked in same color (Fig. 6).

In other words, dominant variables of past periods affect future results more significantly than current variables. Finally, it is quite striking that although this is a model based on non-systemic bank data, administrative costs as well as staff costs are not ranked high in the hierarchy of decision-making variables, although they have been the focus of several restructuring policies and efforts to improve the results of GR UBs.

Regarding the fourth and fifth that is the use of historical data to construct probability distributions for interpretative variables and estimate the model through a Monte Carlo methodology, objective for each of the selected variables through the prior sensitivity analysis we have specialized with historical data curves of probability distributions of different forms for the main interpretative variables with endogenous variables the bank's capital and profits. As we can observe in figures below, using @Risk software with Monte Carlo simulation, we produce the probability distributions for the inputs (Fig. 7) as well as for two above endogenous variables (Figs. 8 and 9).

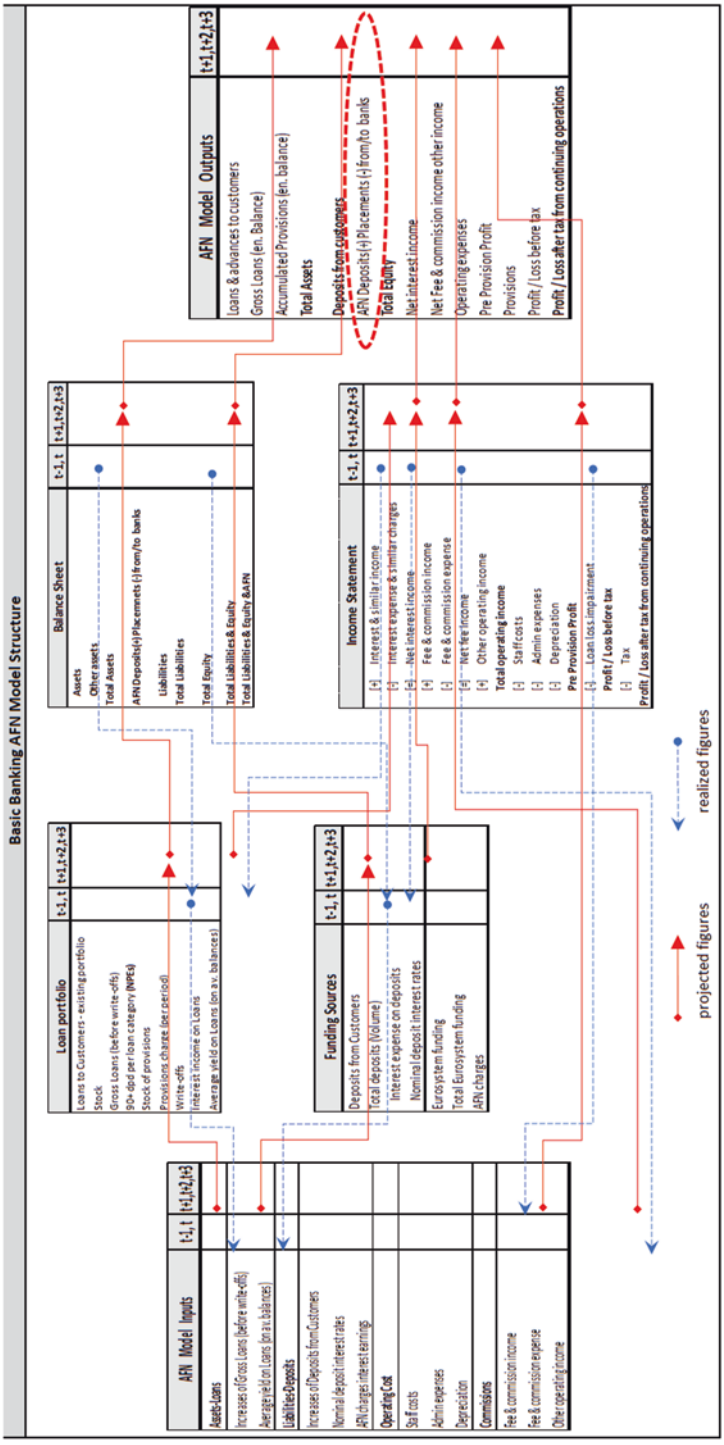

Fig. 4 AFN banking model interdependences

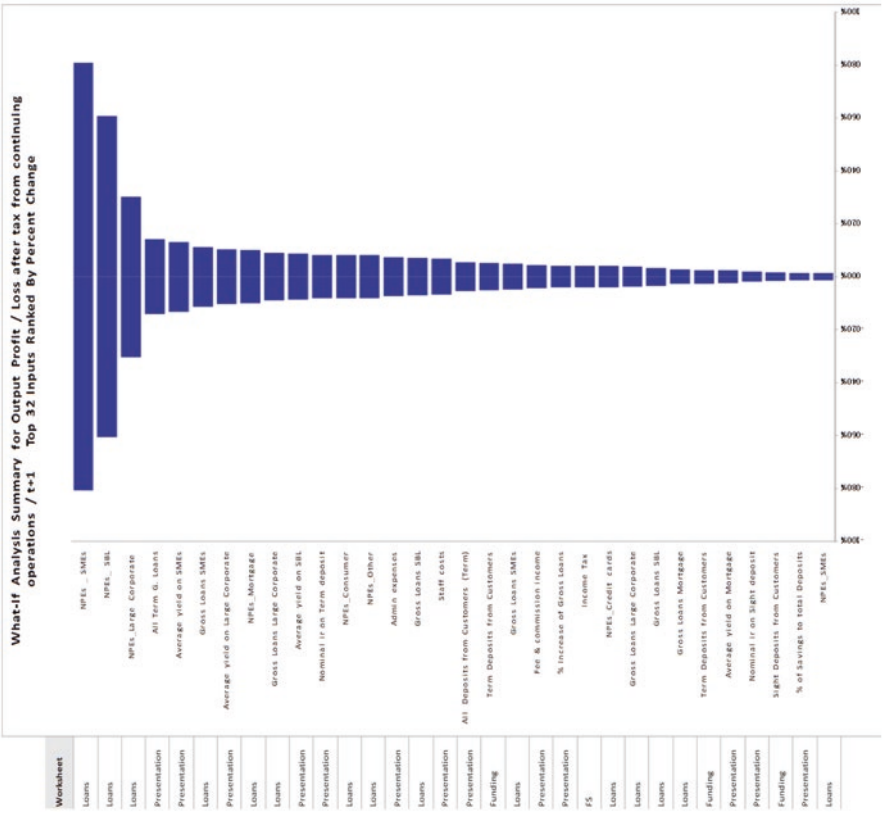

Fig. 5 Tornado graph from what if sensitivity analysis of AFN banking model interdependences

It is noteworthy that the interdependence over time of interpretative variables in influencing the pricing and distribution of the probabilities of the dependent endogenous variables of the model.

Finally, for the sixth objective, after conducting a descriptive statistics and one variable summary analysis of the results on the objective function, the restrictions, and constrains of the GAs problem as illustrated in Table 4, we proceed as illustrated in Tables 5 and 6, where, out of the 10,000 iterations, 2113 failed to meet the constraints and restrictions, while 7887 satisfied them. Also 3392 iterations satisfied the maximization of profits. Thus, we conclude that only 33.92% of iterations have finally passed all constraints and restrictions and satisfies the maximization of profits. The most important conclusion is drawn from the fact that the solutions provided through GAs can construct probability distributions for the interpretative variables of the model that affect profitability.

t+1			t+2			t+3		
Worksheet	Name	Period	Worksheet	Name	Period	Worksheet	Name	Period
Loans	NPEs _ SMEs	t+1	Loans	NPEs _ SMEs	t+2	Loans	NPEs _ SMEs	t+3
Loans	NPEs _ SBL	t+1	Loans	NPEs _ SBL	t+2	Loans	NPEs _ SBL	t+3
Loans	NPEs _ Large Corporate	t+1	Presentation	All Term G. Loans	t+1	Presentation	All Term G. Loans	t+1
Presentation	All Term G. Loans	t+1	Loans	NPEs _ Large Corporate	t+2	Presentation	All Term G. Loans	t+2
Presentation	Average yield on SMEs	t+1	Presentation	Average yield on SMEs	t+2	Loans	NPEs _ Large Corporate	t+3
Loans	Gross Loans SMEs	t	Presentation	All Term G. Loans	t+2	Presentation	Average yield on SMEs	t+3
Presentation	Average yield on Large Corporate	t+1	Loans	Gross Loans SMEs	t+1	Presentation	All Term G. Loans	t+3
Loans	NPEs _ Mortgage	t+1	Loans	Gross Loans SMEs	t	Loans	Gross Loans SMEs	t+2
Loans	Gross Loans Large Corporate	t	Presentation	Average yield on Large Corporate	t+2	Loans	Gross Loans SMEs	t
Presentation	Average yield on SBL	t+1	Loans	NPEs _ Mortgage	t+2	Loans	Gross Loans SMEs	t+1
Presentation	Nominal ir on Term deposit	t+1	Loans	Gros s Loans Large Corporate	t	Presentation	Average yield on Large Corporate	t+3
Loans	NPEs _ Consumer	t+1	Presentation	All Deposits from Customers (Term)	t+1	Loans	NPEs _ Mortgage	t+3
Loans	NPEs _ Other	t+1	Loans	Gross Loans Large Corporate	t+1	Loans	Gross Loans Large Corporate	t+1
Presentation	Admin expenses	t+1	Presentation	Average yield on SBL	t+2	Loans	Gross Loans Large Corporate	t
Loans	Gross Loans SBL	t	Loans	NPEs _ Consumer	t+2	Presentation	Average yield on SBL	t+3
Presentation	Staff costs	t+1	Loans	NPEs _ Other	t+2	Loans	Gross Loans Large Corporate	t+2
Presentation	All Deposits from Customers (Term)	t+1	Presentation	Nominal ir on Term deposit	t+2	Presentation	All Deposits from Customers (Term)	t+2
Funding	Term Deposits from Customers	t	Loans	Gross Loans SBL	t+1	Loans	NPEs _ Consumer	t+3
Loans	Gross Loans SMEs	t+1	Presentation	Staff costs	t+2	Loans	NPEs _ Other	t+3
Presentation	Fee & commission income	t+1	Loans	Gross Loans SBL	t	Loans	Gross Loans SBL	t+2
Presentation	% Increase of Gross Loans	t+1	Presentation	Admin expenses	t+2	Presentation	Nominal IR on Term deposit	t+3
FS	Income Tax	t+1	FS	Income Tax	t+2	Presentation	Staff costs	t+3
Loans	NPEs _ Credit cards	t+1	Loans	Gros s Loans SMEs	t+2	Loans	Gross Loans SBL	t
Loans	Gross Loans Large Corporate	t+1	Presentation	Fee & commission income	t+2	Loans	Gross Loans SBL	t+1
Loans	Gross Loans SBL	t+1	Presentation	All Deposits from Customers (Term)	t+2	Presentation	All Deposits from Customers (Term)	t+1
Loans	Gross Loans Mortgage	t	Funding	Term Deposits from Customers	t+1	FS	Income Tax	t+3
FUNDING	Term Deposits from Customers	t+1	Presentation	% Increase of Gros s Loa ns	t+2	Presentation	Admin expenses	t+3
Presentation	Average yield on Mortgage	t+1	Loans	NPEs _ Credit cards	t+2	Loans	Gross Loans SMEs	t+3
Presentation	Nominal ir on Sight deposit	t+1	Loans	Gross Loans Mortgage	t	Presentation	Fee & commission income	t+3
FUNDING	Sight Deposits from Customers	t	Loans	Gross Loans Large Corporate	t+2	Presentation	All Deposits from Customers (Term)	t+3
Presentation	% of Savings to total Deposits	t+1	Loans	Gross Loans SBL	t+2	Funding	Term Depos its from Customers	t+2
Loans	NPEs _ SMEs	t	Loans	Gross Loans Mortgage	t+1	Loans	Gross Loans Mortgage	t+1

Source: *Liapis and Trigkas (2019).*

Fig. 6 Dominant variables effect over different time periods marked in same color. Source: Liapis and Trigkas (2019)

Name	Cell	Graph	Function	Min	Mean	Max
Category: Admin expenses						
Admin expenses / t+1	G37		RiskPert(32,4;36;39,6;RiskStatic(36))	32,4	36	39,6
Admin expenses / t+2	H37		RiskPert(32,4;36;39,6;RiskStatic(36))	32,4	36	39,6
Admin expenses / t+3	I37		RiskPert(32,4;36;39,6;RiskStatic(36))	32,4	36	39,6
Name	Cell	Graph	Function	Min	Mean	Max
Category: Depreciation						
Depreciation / t+1	G38		RiskPert(5,4;6;6,6;RiskStatic(6))	5,4	6	6,6
Depreciation / t+2	H38		RiskPert(5,4;6;6,6;RiskStatic(6))	5,4	6	6,6
Depreciation / t+3	I38		RiskPert(5,4;6;6,6;RiskStatic(6))	5,4	6	6,6
Name	Cell	Graph	Function	Min	Mean	Max
Category: Fee & commission expense						
Fee & commission expense / t+1	G41		RiskPert(3,6;4;4,4;RiskStatic(4))	3,6	4	4,4
Fee & commission expense / t+2	H41		RiskPert(3,6;4;4,4;RiskStatic(4))	3,6	4	4,4
Fee & commission expense / t+3	I41		RiskPert(3,6;4;4,4;RiskStatic(4))	3,6	4	4,4

Fig. 7 Dominant input variables probability distributions by Monte Carlo simulation

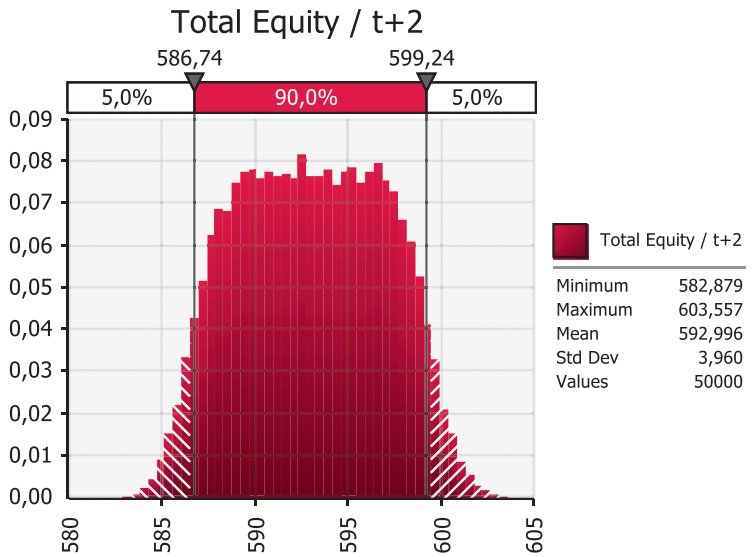

Fig. 8 Total equity endogenous variable probability distribution by Monte Carlo simulation

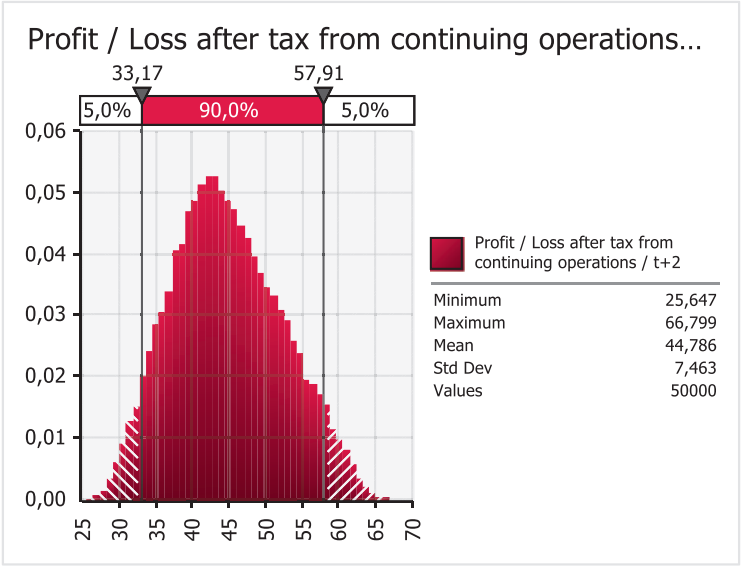

Fig. 9 Profit/Loss endogenous variable probability distribution by Monte Carlo simulation

8 Conclusions

In Relation to the First Objective of the study of theories of multinational banks:

- the basic policy that had been developed theoretically to deal with crises through deleveraging was not followed in the early stages of the crisis.
- the theory of risk diversification in multinational banks is verified, in relation to the profitability of Greek multinational banks.

As a constraint, it is pointed out that we were unable to investigate, because the efficiency of the external sector remained strong in the early stages of the crisis, whether this was carried out on the basis of a bank policy or on the basis of global or European institutional prohibitions on not diffusing the crisis of the Greek economy, such as the Vienna Treaty or informally called as the Vienna Initiative.

In Relation to the Other Objectives of developing models and introducing statistical methods:

The AFN prototype developed can meet the needs of planning, budgeting and preliminary audits, business plans and stress testing, and is also compatible with the reporting standards of the supervisory and regulatory authorities of ECB, EBA, DG Comp, and has already been adequately implemented in a small and medium-sized Greek bank.

Table 4 Descriptive Statistics and One Variable Summary Analysis of the results on the objective function, the restrictions, and constrains of the GAs problem

		LOANS									DEPOSITS				
		Mortgage	Consumer	Credit cards	Other	Public sector	Large Corporate	SMEs	SBL	Increases of Gross Loans	Savings	Sight	Term	Other	Increases of Deposits
Mean	54.18 €	10.04%	2.30%	2.56%	3.07%	4.74%	12.56%	34.82%	29.91%	0.00%	29.73%	28.71%	40.12%	1.44%	0.48%
Variance	5.53%	0.00%	0.00%	0.01%	0.00%	0.00%	0.01%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.02%
Std. Dev.	23.51%	0.12%	0.62%	0.99%	0.20%	0.62%	0.95%	0.44%	0.22%	0.00%	0.48%	0.47%	0.28%	0.12%	1.32%
Skewness	-1.17	7.56	2.39	1.58	5.36	-3.10	-1.10	-4.58	-4.76	11.44	-1.81	0.95	3.91	-2.63	2.69
Minimum	53.50 €	10.00%	2.00%	2.00%	3.00%	1.00%	10.00%	27.81%	26.92%	0.00%	26.61%	25.17%	40.00%	1.00%	0.00%
Maximum	54.34 €	12.06%	5.00%	5.00%	6.00%	5.00%	17.88%	35.00%	30.00%	0.09%	30.00%	30.00%	43.35%	1.50%	5.00%
Range	0.84 €	2.06%	3.00%	3.00%	3.00%	4.00%	7.88%	7.19%	3.08%	0.09%	3.39%	4.83%	3.35%	0.50%	5.00%
Count	3,392	3,392	3,392	3,392	3,392	3,392	3,392	3,392	3,392	3,392	3,392	3,392	3,392	3,392	3,392
1%	53.56 €	10.00%	2.00%	2.00%	3.00%	2.00%	10.00%	32.87%	29.07%	0.00%	28.32%	27.85%	40.00%	1.00%	0.00%
3%	53.63 €	10.00%	2.00%	2.00%	3.00%	2.62%	10.00%	33.60%	29.29%	0.00%	28.53%	28.16%	40.00%	1.00%	0.00%
5%	53.69 €	10.00%	2.00%	2.00%	3.00%	3.37%	10.29%	33.93%	29.45%	0.00%	28.64%	28.38%	40.00%	1.17%	0.00%
10%	53.77 €	10.00%	2.00%	2.00%	3.00%	4.00%	10.94%	34.37%	29.68%	0.00%	28.85%	28.50%	40.00%	1.32%	0.00%
20%	53.97 €	10.00%	2.00%	2.00%	3.00%	4.65%	11.95%	34.78%	29.90%	0.00%	29.40%	28.50%	40.00%	1.40%	0.00%
80%	54.34 €	10.05%	2.46%	3.14%	3.09%	5.00%	13.00%	35.00%	30.00%	0.00%	30.00%	29.00%	40.17%	1.50%	0.06%
90%	54.34 €	10.12%	3.20%	4.60%	3.19%	5.00%	13.01%	35.00%	30.00%	0.00%	30.00%	29.56%	40.42%	1.50%	2.04%
95%	54.34 €	10.19%	3.85%	4.95%	3.31%	5.00%	13.27%	35.00%	30.00%	0.01%	30.00%	29.80%	40.69%	1.50%	4.64%
98%	54.34 €	10.25%	4.27%	4.98%	3.67%	5.00%	13.67%	35.00%	30.00%	0.01%	30.00%	29.92%	40.91%	1.50%	4.78%
99%	54.34 €	10.50%	4.67%	5.00%	4.10%	5.00%	14.30%	35.00%	30.00%	0.02%	30.00%	30.00%	41.36%	1.50%	4.99%

Table 5 Summary of the results on the objective equation of the GA problem

Goal	
Cell to optimize	Profit after tax from continuing operations
Type of goal	Maximum
Results	
Valid trials	7887.00
Total trials	10,000.00
Original value	41.10
+ Soft constraint penalties	–
= Result	41.10
Best value found	54.18
+ Soft constraint penalties	–
= Result	54.34
Best trial number	60.00
Adjustable cell values	Mortgage
Original	10%
Best	10%
Adjustable cell values	Consumer
Original	2%
Best	2%
Adjustable cell values	Credit cards
Original	2%
Best	2%
Adjustable cell values	Other
Original	3%
Best	3%
Adjustable cell values	Public sector
Original	5%
Best	5%
Adjustable cell values	Large corporate
Original	13%
Best	13%
Adjustable cell values	SMEs
Original	35%
Best	35%
Adjustable cell values	SBLs
Original	30%
Best	30%
Adjustable cell values	Savings
Original	30%
Best	30%
Adjustable cell values	Sight
Original	29%
Best	29%
Adjustable cell values	Term

(continued)

Table 5 (continued)

Goal	
Cell to optimize	Profit after tax from continuing operations
Type of goal	Maximum
Results	
Original	40%
Best	40%
Adjustable cell values	Other
Original	2%
Best	2%
Adjustable cell values	Increase of gross loans
Original	2%
Best	0%
Adjustable cell values	Increase of deposits
Original	2%
Best	0%

Table 6 Summary of the constraints on the objective equation of the GA problem

Constraints	
Description	All of Gross Loans = 100%
Definition	G12 = 1
Constraint type	Hard
Precision	1.00E-03
Satisfied for % of trials	100.00%
Description	All Deposits from Customers = 100%
Definition	G28 = 1
Constraint type	Hard
Precision	1.00E-03
Satisfied for % of trials	100.00%
Description	Loans and Advances <= Total Equity and Deposits
Definition	R3 <= R14
Constraint type	Hard
Precision	0
Satisfied for % of trials	78.87%

The sensitivity analysis technique used drew conclusions on the behavior, response and sensitivity of the efficiency and profitability of a banking company, in a complete, adequate, hard theoretical and technical manner.

Through an original simulation process, under conditions of uncertainty, by combining AFN methodology model with Monte Carlo simulation, the research demonstrates that, by shaping the probability distributions of interpretative variables, using historical data, we can extract the probability distributions of interpretative objectives for controlling the profitability of a banking company, identifying and confidence intervals for them, in a more comprehensive and reliable manner,

compared to the other methodologies followed and as reported in the literature review. Finally, the completion of research through the introduction of advanced methods and operational research with GAs in Banking and Managerial Accounting is original, adequate, feasible and effective, with the potential for expansion in the construction of integrated programming models, using all interpretative variables that affect the profitability of a banking company, while combining important additional theoretical and practical fields with competence.

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Diffusion and Brownian Motion Processes in Modeling the Costs of Supporting Non-autonomous Pension Funds

M. A. M. Ferreira and José António Filipe

Abstract In this chapter, we consider pensions funds not sufficiently auto financed and systematically maintained with an outside financing effort, usually non-autonomous pension's funds. This financial effort, made by the managing entity, translates as capital injections into the fund. The objective of this work is to develop a tool that allows predicting the appropriate moments to carry out these interventions and the respective amounts. So, we propose to represent the unrestricted reserves value process of this kind of funds, through a time homogeneous diffusion process with finite expected time till the ruin. A financial tool that regenerates the diffusion is also admitted, at some level with positive value every time it hits a barrier at the origin. Then the financing effort may be modeled as a renewal-reward process if the regeneration level is kept constant. The perpetual maintenance cost expected values evaluation and of the finite time maintenance cost are studied. Then, we focus on a particular situation of this approach, arising when the unrestricted reserves value process behaves as a generalized Brownian motion process.

Keywords Pensions fund · Diffusion process · First passage times · Renewal equation

M. A. M. Ferreira
University Institute of Lisbon (ISCTE-IUL), Information Sciences, Technologies, and Architecture Research Center (ISTAR-IUL), Business Research Unit (BRU-IUL), Lisbon, Portugal

J. A. Filipe (✉)
Department of Mathematics, ISTA–School of Technology and Architecture, University Institute of Lisbon (ISCTE-IUL), Information Sciences, Technologies, and Architecture Research Center (ISTAR-IUL), Business Research Unit (BRU-IUL), Lisbon, Portugal
e-mail: jose.filipe@iscte-iul.pt

K. Nermend et al. (eds.), *Decision-Making in Management*, Contributions to Management Science, https://doi.org/10.1007/978-3-030-67020-7_5

1 Introduction

Pension funds represent savings collected along people's working life. Pension funds that support personal pension plans are intended to be autonomous. They represent the highest level of protection to the beneficiary from the bankruptcy of the sponsor, especially when the custodian is involved. Non-autonomous pension funds are not legally separated from the plan sponsor but are kept on its balance sheet. In this case, there is the lowest protection level to the beneficiary from bankruptcy of the sponsor, since the sponsor can use pension's assets to fund its business, see Impavido (2012).

The financial problem of asset-liability management scheme of a pensions fund requires a management program that demands a set of decisions. In particular, the amounts and the instants at which it is necessary to inject money in the fund in order to keep it sustainable. Sponsors are obviously interested in an appropriate management of the risk for their pension funds. Well and balanced funded pension funds result essential in this process of funds management.

Through this chapter we develop a mathematical tool that allows predicting, in a probabilistic mode, the appropriate moments to carry out these money injections and the respective amounts.

This issue is particularly relevant since we know that pension funds are continuously exposed to the market's situation. And the recent financial crises and turbulent stock markets circumstances made the problem of pension's funds management to receive an enormous attention. Many pensions' funds suffered dramatic losses, and this is a problematic issue that managers want to overcome the best they can. So, managerial tools allow a better decision-making.

The protection cost present value expectation for a non-autonomous pensions' fund is considered in this work. Two contexts are considered:

- The protection effort is perpetual,
- The protection effort happens for a finite time period.

It is admitted that the unrestricted fund reserves behavior may be modeled as a time homogeneous diffusion process. Then a regeneration scheme of the diffusion to include the effect of an external financing effort is used.

This chapter is an updated and enlarged version of Ferreira (2012), where was mainly considered the diffusion process.

In Gerber and Parfumi (1998) a similar work is presented. A Brownian motion process conditioned by a reflection scheme was considered. With less constraints, but in different conditions, exact solutions were then obtained for both problems.

The work presented in Refait (2000), on asset-liability management aspects, also motivated the use of the Brownian motion application example in that domain.

So, in this chapter we extend the results presented in Ferreira (2012), better specifying the diffusion process mathematical details, and deeply exploring the Brownian motion process situation.

Other works on this subject are Figueira and Ferreira (2003) and Figueira (2003), both dealing with the diffusion process case. The works Filipe et al. (2012), Andrade et al. (2012a, b), Ferreira et al. (2011) and Ferreira et al. (2012) deal with other financial problems, slightly different from the presently considered here, but relevant to their understanding and framing. In particular Andrade et al. (2012a, b) and Ferreira et al. (2012) present the problem of state pension funds, in which workers 'contributions are currently insufficient to pay pensioners' pensions due to demographic imbalances that occur in modern societies. In this case, state budgets have to include capitals to balance these funds. The tool that we are going to develop can be applied in this situation, contributing for the transfers to be made in a scheduled manner, at the times and amounts due, in a more efficient way.

2 Pensions Fund Reserves Behavior Stochastic Model

Be X(t), $t \geq 0$ the reserves value process of a pensions fund given by an initial reserve amount a, $a > 0$ added to the difference between the total amount of contributions received and the total amount of pensions paid both up to time t. It is assumed that X(t) is a time homogeneous diffusion process, with X(0) = a, defined by drift and diffusion coefficients $\mu(x)$ and $\sigma^2(x)$,respectively.

Call S_a the first passage time of X(t) by 0, coming from a. The funds to be considered in this work are non-autonomous funds. So

$$E\left[S_a\right] \langle \infty, \text{for any a} \rangle 0 \tag{1}$$

That is: funds where the pensions paid consume in finite expected time any initial positive reserve and the contributions received. Then other financing resources are needed in order that the fund survives.

The condition (1) may be fulfilled for a specific diffusion process using criteria based on the drift and diffusion coefficients. In this context, here the work presented in Bhattacharya and Waymire (1990), pg. 418–422, is followed. So, accept that $P(S_a < \infty) = 1$ if the diffusion scale function is $q(x) = \int_{x_0}^{x} e^{-\int_{x_0}^{z} \frac{2\mu(y)}{\sigma^2(y)} dy} dz$, where x_0 is a diffusion state space fixed arbitrary point, fulfilling $q(\infty) = \infty$.

Then the condition (1) is equivalent to $p(\infty) < \infty$, where $p(x) = \int_{x_0}^{x} \frac{2}{\sigma^2(z)} e^{\int_{x_0}^{z} \frac{2\mu(y)}{\sigma^2(y)} dy} dz$,

is the diffusion speed function.

It is admitted that whenever the exhaustion of the reserves happens an external source places instantaneously an amount θ, $\theta > 0$ of money in the fund so that it may keep on performing its function.

The reserves value process conditioned by this financing scheme is denoted by the modification $\overset{\vee}{X}(t)$ of X(t) that restarts at the level θ whenever it hits 0. As X(t)

was defined as a time homogeneous diffusion, $\overset{v}{X}(t)$ is a regenerative process. Call $T_1, T_2, T_3, \ldots$ the sequence of random variables where T_n denotes the n^{th} $\overset{v}{X}(t)$ passage time by 0. It is obvious that the sequence of time intervals between these hitting times $D_1 = T_1$, $D_2 = T_2 - T_1$, $D_3 = T_3 - T_2$, … is a sequence of independent random variables where D_1 has the same probability distribution as S_a and $D_2, D_3, \ldots$ the same probability distribution as S_θ.

3 First Passage Times Laplace Transforms

Call $f_a(s)$ the probability density function of S_a(related to D_1). The corresponding probability distribution function is denoted by $F_a(s)$. The Laplace transform of S_a is denoted $\varphi_a(\lambda)$.

Consequently, the density, distribution and transform of S_θ (related to $D_2, D_3, \ldots$) will be denoted by $f_\theta(s)$, $F_\theta(s)$ and $\varphi_\theta(\lambda)$,respectively.

The transform $\varphi_a(\lambda)$ satisfies the second order differential equation

$$\begin{aligned} &\frac{1}{2}\sigma^2(a)u_\lambda''(a)+\mu(a)u_\lambda'(a)=\lambda u_\lambda(a), \\ &u_\lambda(a)=\varphi_a(\lambda), u_\lambda(0)=1, u_\lambda(\infty)=0, \end{aligned} \tag{2}$$

See Feller (1971), pg. 478, Karlin and Taylor (1981), pg. 243 and Bass (1998), pg. 89.

4 Perpetual Maintenance Cost Present Value

Consider the perpetual maintenance cost present value of the pension's fund given by the random variable $V(r,a,\theta)=\sum_{n=1}^{\infty}\theta e^{-rT_n}$, r>0, where r represents the appropriate discount rate. Note that V(r, a, θ) is a random perpetuity. What matters is its expected value which is simple to calculate through Laplace transforms. Since the T_n Laplace transform is

$$E\left[e^{-\lambda T_n}\right]=\varphi_a(\lambda)\varphi_\theta^{n-1}(\lambda),$$

$$v_r(a,\theta)=E\left[V(r,a,\theta)\right]=\frac{\theta\varphi_a(r)}{1-\varphi_\theta(r)} \tag{3}$$

It is relevant to note that

$$\lim_{\theta\to 0} v_r(a,\theta) = \frac{u_r(a)}{-u_r'(0)} \tag{4}$$

5 Finite Time Period Maintenance Cost Present Value

Define the renewal process N(t) as $N(t) = \sup\{n : T_n \le t\}$, generated by the extended sequence $T_0 = 0, T_1, T_2, \ldots$. The present value of the pensions fund maintenance cost up to time t is represented by the stochastic process.

$$W(t;r,a,\theta) = \sum_{n=1}^{N(t)} \theta e^{-rT_n}, W(t;r,a,\theta) = 0 \text{ if } N(t) = 0.$$

To calculate the expected value function of the process evaluation :$w_r(t;a,\theta) = E[W(t;r,a,\theta)]$, begin noting that it may be expressed as a numerical series. Indeed, evaluating the expected value function conditioned by N(t) = n, it is obtained $E\left[W(t;r,a,\theta)\middle|N(t) = n\right] = \theta\varphi_a(r)\dfrac{1-\varphi_\theta^n(r)}{1-\varphi_\theta(r)}$.

Repeating the expectation:

$$w_r(t;a,\theta) = E\left[E\left[W(t;r,a,\theta)\right]\middle|N(t)\right] = \theta\varphi_a(r)\frac{1-\gamma(t,\varphi_\theta(r))}{1-\varphi_\theta(r)} \tag{5}$$

Here $\gamma(t,\xi)$ is the probability generating function of N(t).

Denote now the T_n probability distribution function by $G_n(s)$ and assume $G_0(s) = 1$, for $s \ge 0$. Recalling that $P(N(t) = n) = G_n(t) - G_{n+1}(t)$, the above mentioned probability generating function is.

$$\gamma(t,\xi) = \sum_{n=0}^{\infty}\xi^n P(N(t) = n) = 1-(1-\xi)\sum_{n=1}^{\infty}\xi^{n-1}G_n(t) \tag{6}$$

Substituting (6) in (5), $w_r(t;a,\theta)$ is expressed in the form of the series

$$w_r(t;a,\theta) = \theta\varphi_a(r)\sum_{n=1}^{\infty}\varphi_\theta^{n-1}(r)G_n(t) \tag{7}$$

Call the $w_r(t;a,\theta)$ ordinary Laplace transform $\psi(\lambda)$. The probability distribution function $G_n(s)$, of T_n,ordinary Laplace transform is given $\varphi_a(\lambda)\dfrac{\varphi_\theta^{n-1}(\lambda)}{\lambda}$ and performing the Laplace transforms in both sides of (7) it is obtained $\psi(\lambda) = \dfrac{\theta\varphi_a(r)\varphi_a(\lambda)}{\lambda(1-\varphi_\theta(r)\varphi_\theta(\lambda))}$ or

$$\psi(\lambda) = \theta\varphi_a(r)\frac{\varphi_a(\lambda)}{\lambda} + \psi(\lambda)\varphi_\theta(r)\varphi_\theta(\lambda). \tag{8}$$

Inverting Laplace transforms in both sides of (8) the following defective renewal equation is got:

$$w_r(t;a,\theta) = \theta\varphi_a(r)F_a(t) + \int_0^t w_r(t-s;a,\theta)\varphi_\theta(r)f_\theta(s)ds. \tag{9}$$

Now an asymptotic approximation of $w_r(t;a,\theta)$ will be obtained through the key renewal theorem, see Bhattacharya and Waymire (1990), pg. 376.

If in (9) $t \to \infty$

$$w_r(\infty;a,\theta) = \theta\varphi_a(r) + w_r(\infty;a,\theta)\varphi_\theta(r). \tag{10}$$

Or $w_r(\infty;a,\theta) = \dfrac{\theta\varphi_a(r)}{1-\varphi_\theta(r)} = v_r(a,\theta)$.

This is the expression (3) for $v_r(a,\theta)$. Subtracting each side of (10) from each side of (9), and performing some elementary calculations the following, still defective, renewal eq.

$$J(t) = j(t) + \int_0^t J(t-s)\varphi_\theta(r)f_\theta(s)ds. \tag{11}$$

Here $J(t) = w_r(\infty;a,\theta) - w_r(t;a,\theta)$ and

$$j(t) = \theta\varphi_a(r)(1-F_a(t)) + \frac{\theta\varphi_a(r)\varphi_\theta(r)}{1-\varphi_\theta(r)}(1-F_\theta(t)).$$

Now, to obtain a common renewal equation from (11), it must be admitted the existence of a value $k > 0$ such that $\int_0^\infty e^{ks}\varphi_\theta(r)f_\theta(s)ds = \varphi_\theta(r)\varphi_\theta(-k) = 1$.

So, the transform $\varphi_\theta(\lambda)$ is defined in a domain different from the initially considered. That is, a domain including a convenient subset of the negative real numbers.

Multiplying both sides of (11) by e^{kt} the common renewal equation desired is finally obtained: $e^{kt}J(t) = e^{kt}j(t) + \int_0^t e^{k(t-s)}J(t-s)e^{ks}\varphi_\theta(r)f_\theta(s)ds$ from which, by the application of the key renewal theorem, it results

$$\lim_{t\to\infty} e^{kt}J(t) = \frac{1}{k_0}\int_0^\infty e^{ks}j(s)ds. \tag{12}$$

And $k_0 = \int_0^\infty se^{ks}\varphi_\theta(r)f_\theta(s)ds = \varphi_\theta(r)\varphi'_\theta(-k)$, since $e^{kt}j(t)$ is directly Riemann integrable. The integral in (12) may be expressed in terms of transforms as $\int_0^\infty e^{ks}j(s)ds = \dfrac{\theta\varphi_a(r)\varphi_a(-k)}{k}$.

So, an asymptotic approximation, in the sense of (12) was obtained:

$$w_r(t;a,\theta) \approx v_r(a,\theta) - c_r(a,\theta)e^{-k_r(\theta)t}. \tag{13}$$

Here $k_r(\theta)$ is the positive value of k that fulfills:

$$\varphi_\theta(r)\varphi_\theta(-k) = 1. \tag{14}$$

And

$$c_r(a,\theta) = \frac{\theta\varphi_a(r)\varphi_a(-k_r(\theta))}{-k_r(\theta)\varphi_\theta(r)\varphi_\theta'(-k_r(\theta))}. \tag{15}$$

6 Brownian Motion Example

Suppose the diffusion process X(t) , underlying the reserves value behavior of the pension's fund, is a generalized Brownian motion process, with drift $\mu(x) = \mu$, $\mu < 0$ and diffusion coefficient $\sigma^2(x) = \sigma^2$, $\sigma > 0$. Observe that the setting satisfies the conditions that were assumed above in this work. Namely $\mu < 0$ implies condition (1). Everything else remaining as previously stated, it will be proceeded to present the consequences of this particularization. In general, it will be added $(*)$ to the notation used before because it is intended to use these specific results later.

To obtain the first passage time S_a Laplace transform, remember (2), it must be solved the equation: $\frac{1}{2}\sigma^2(a)u_\lambda^{*''}(a) + \mu(a)u_\lambda^{*'}(a) = \lambda u_\lambda^*(a), u_\lambda^*(a) = \varphi_a(\lambda), u_\lambda^*(0) = 1$ $u_\lambda^*(\infty) = 0$. This is a homogeneous second order differential equation with constant coefficients, which general solution is $u_\lambda^*(a) = \beta_1 e^{\alpha_1 a} + \beta_2 e^{\alpha_2 a}$, with $\alpha_1, \alpha_2 = \frac{-\mu \pm \sqrt{\mu^2 + 2\lambda\sigma^2}}{\sigma^2}$.

Condition $u_\lambda^*(\infty) = 0$ implies $\beta_1 = 0$ and $u_\lambda^*(0) = 1$ implies $\beta_2 = 1$ so that the solution is achieved:

$$u_\lambda^*(a) = e^{-K_\lambda a}\left(= \varphi_a^*(\lambda)\right), K_\lambda = \frac{\mu + \sqrt{\mu^2 + 2\lambda\sigma^2}}{\sigma^2}. \tag{16}$$

In this case, the perpetual maintenance cost present value of the pensions fund is given by, following (3) and using (16),

$$v_r^*(a,\theta) = \frac{\theta e^{-K_r a}}{1 - e^{-K_r \theta}}. \tag{17}$$

Note that $v_r^*(a,\theta)$ is a decreasing function of the first variable and an increasing function of the second. Proceeding as before, in particular:

$$\lim_{\theta\to 0} v_r^*(a,\theta) = \frac{e^{-K_r a}}{K_r}. \tag{18}$$

This expression has been obtained in Gerber and Parfumi (1998), in a different context and using different methods but, obviously, with identical significance. In Gerber and Parfumi (1998), the authors acted with a generalized Brownian motion, with no constraints in what concerns the drift coefficient, conditioned by a reflection scheme at the origin.

A way to reach an expression for the finite time period maintenance cost present value, is starting by the computation of $k_r^*(\theta)$, solving (14). This means to determine a positive number k satisfying $e^{-K_r\theta}e^{-K_{-\lambda}\theta} = 1 \text{ or } K_r + K_{-\lambda} = 0$.

This identity is verified for the value of k:

$$k_r^*(\theta) = \frac{\mu^2 - \left(-2\mu - \sqrt{\mu^2 + 2r\sigma^2}\right)^2}{2\sigma^2}, \text{if } \mu < -\sqrt{\frac{2r\sigma^2}{3}} \tag{19}$$

Note that the solution is independent of θ in these circumstances. A simplified solution, independent from *a* and *θ*, for $c_r^*(a,\theta)$ was also obtained. Using (15) the result is

$$c_r^*(a,\theta) = \frac{2\sigma^2\left(-2\mu - \sqrt{\mu^2 + 2r\sigma^2}\right)}{\mu^2 - \left(-2\mu - \sqrt{\mu^2 + 2r\sigma^2}\right)^2} \tag{20}$$

Combining these results, (19) and (20), as in (13) it is observable that the asymptotic approximation for this particularization reduces to $w_r^*(t;a,\theta) \approx v_r^*(a,\theta) - \pi_r(t)$, where the function $\pi_r(t)$ is, considering (19) and (20),

$$\pi_r(t) = \frac{2\sigma^2\left(-2\mu - \sqrt{\mu^2 + 2r\sigma^2}\right)}{\mu^2 - \left(-2\mu - \sqrt{\mu^2 + 2r\sigma^2}\right)^2} e^{-\frac{\mu^2 - \left(-2\mu - \sqrt{\mu^2 + 2r\sigma^2}\right)^2}{2\sigma^2}t}, \text{if } \mu < -\sqrt{\frac{2r\sigma^2}{3}}. \tag{21}$$

7 The Assets and Liability Behavior Representation

In this section it is presented an application of the results obtained above to an asset-liability management scheme of a pension's fund. Assume that the assets value process of a pensions fund may be represented by the geometric Brownian motion process

$$A(t) = be^{a+(\rho+\mu)t+\sigma B(t)} \text{ with } \mu \langle 0 \text{ and } ab\rho + \mu\sigma \rangle 0,$$

where B(t) is a standard Brownian motion process. Suppose also that the fund liabilities value process performs such as the deterministic process $L(t) = be^{\rho t}$.

Consider now the stochastic process Y(t) obtained by the elementary transformation of A(t), $Y(t) = \ln \frac{A(t)}{L(t)} = a + \mu t + \sigma B(t)$.

This is a generalized Brownian motion process exactly as the one studied before, starting at a, with drift μ and diffusion coefficient σ^2. Note also that the firs passage time of the assets process A(t) by the mobile barrier T_n, the liabilities process, is the first passage time of Y(t) by 0-with finite expected time under the condition, stated before, $\mu < 0$.

Consider also the pensions fund management scheme that raises the assets value by some positive constant θ_n, when the assets value falls equal to the liabilities process by the n^{th} time. This corresponds to consider the modification $\bar{A}(t)$ of the process A(t) that restarts at times T_n when A(t) hits the barrier L(t) by the n^{th} time at the level $L(T_n) + \theta_n$. For purposes of later computations, it is a convenient choice of the management policy where

$$\theta_n = L(T_n)\left(e^{\theta} - 1\right), \text{for some } \theta > 0. \tag{22}$$

The corresponding modification $\tilde{Y}(t)$ of $Y(t)$ will behave as a generalized Brownian motion process that restarts at the level $\ln \frac{L(T_n) + \theta_n}{L(T_n)} = \theta$ when it hits 0 (at times T_n).

Proceeding this way, it is reproduced via $\tilde{Y}(t)$ the situation observed before when the Brownian motion example was treated. The Laplace transform in (16) is still valid.

Similarly, to former proceedings, the results for the present case will be distinguished with the symbol (#). It is considered the pensions fund perpetual maintenance cost present value, because of the proposed asset-liability management scheme, given by the random variable: $V^{\#}(r,a,\theta) = \sum_{n=1}^{\infty} \theta_n e^{-rT_n} = \sum_{n=1}^{\infty} b\left(e^{\theta} - 1\right) e^{-(r-\rho)T_n}, r > \rho$, where r represents the appropriate discount interest rate. To obtain the above expression it was only made use of the L(t) definition and (22). Note that it is possible to express the expected value of the above random variable with the help of (17) as

$$v_r^{\#}(a,\theta) = \frac{b\left(e^{\theta}-1\right)}{\theta} v_{r-\rho}^{*}(a,\theta) = \frac{b\left(e^{\theta}-1\right)e^{-K_{r-\rho}a}}{1-e^{-K_{r-\rho}\theta}}. \tag{23}$$

As $\theta \to 0$

$$\lim_{\theta\to 0} v_r^{\#}(a,\theta) = \frac{be^{-K_{r-\rho}a}}{K_{r-\rho}}. \tag{24}$$

Another expression that may be found in Gerber and Parfumi (1998).

In a similar way, the maintenance cost up to time t in the above-mentioned management scheme, is the stochastic process $W^{\#}(t;r,a,\theta) = \sum_{n=1}^{N(t)} b\left(e^{\theta}-1\right)e^{-(r-\rho)T_n}$, $W^{\#}(t;r,a,\theta) = 0$ if $N(t) = 0$, with expected value function

$$w_r^{\#}(t;a,\theta) = \frac{b\left(e^{\theta}-1\right)}{\theta} w_{r-\rho}^{*}(t;a,\theta). \tag{25}$$

The results of Sect. 6 with r replaced by $r - \rho$ may be combined as in (25) to obtain an asymptotic approximation.

8 Conclusions

This chapter presents a stochastic processes tool to study the maintenance costs of a pension's fund, supporting the fund managers and contributing for an adequate decisions planning. In general diffusion setting, the main results are formulae (3) and (13). The whole work depends on equation (2) solvability, in order to obtain the first passage times Laplace transforms. But the known solutions happen only in very rare cases. An obvious case, for which the equation solution is available, is the Brownian motion diffusion process. The main results concerning this particularization are formulae (17) and (21). Certain Brownian motion process transformations, that allowed to make use of the available Laplace transform, may be explored as it was done in Sect. 7. Formulae (23) and (25) are this case most relevant results.

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The Use of Epigenetics in Decision-Making to Activate Marginalized Communities

Beata Skubiak

Abstract Social phenomena have an impact on the processes of economic development and therefore the problem of marginalization and social exclusion is important.

The aim of the chapter is to show how the results of research in the area of the so-called neuroscience, including epigenetics, can contribute to dealing with social problems in people belonging to marginalized groups. In order to achieve the goal formulated in this sense (as stated in the headline of this chapter), the author in the following parts of this chapter describes marginalized communities and discusses the current methods of their activation, on the basis of research in the field of neuroscience, including epigenetics, and in a general manner explains the behavior of marginalized people and what knowledge comes from this research for further work with such groups of people. Various research methods were used in the study, covering both primary and secondary data, including: literature studies on compact studies, as well as journals and other publications necessary in the creation of the theoretical part of the work, inference and synthesis for the overall study.

Keywords Epigenetics · Decisions · Marginalized groups

1 Introduction

Community development and decision-making are closely related. Good decisions result in development at different levels. Each decision-making process can contribute to the change and development of an individual, organization or area towards their greater effectiveness.

The basic need of every human being is the actual feeling of "well-being" (defined by WHO as a subjective perception of *satisfaction* with the physical, mental and social state of one's life perceived by the individual person; the indicators of which are, among others, optimism in life, a sense of influence on one's life and a

B. Skubiak (✉)
University of Szczecin, Szczecin, Poland

K. Nermend et al. (eds.), *Decision-Making in Management*, Contributions to Management Science, https://doi.org/10.1007/978-3-030-67020-7_6

sense of internal control, adequate -but not lowered by helplessness- educational aspirations and competences as well as thinking in terms of long-term needs). Marginalized communities are characterized by a condition characteristic of the sociological and psychological climate of areas where residents are exposed to social exclusion and social isolation. Marginalized communities are characterized by low professional and social activity, with high rates of life pessimism, low responsibility for one's life, a sense of external control, as well as low educational aspirations and thinking in terms of short-term needs. This perpetuates non-developmental life patterns and a culture of poverty and helplessness which is inherited by the next generations of people from that community. They all dream of improving their fate, although they lack the tools to change and the examples of people who managed to succeed around them. The need for development and activity is in every person, even if it is deeply hidden, it still can be awakened and released.

The question here is how can this be done? Trying to answer this question will help policymakers, consultants, managers, boards of directors and social workers to get a good reference to working "for and with" marginalized communities, which is the purpose of this article.

In order to achieve the goal formulated in this way, the author in the following parts of this chapter describes marginalized communities and discusses the current methods of their activation, on the basis of research in the field of neuroscience, including epigenetics, and in a general manner explains the behavior of marginalized people and what knowledge comes from this research for further work with such communities. This article ends with conclusions and practical recommendations for decision-makers.

This chapter was inspired by the author's personal experience in working with marginalized people and an attempt to answer the question why the activating measures taken do not bring the desired results, and that generally the excluded people are not really interested in changing their social status.

2 Marginalized Communities and Their Activation

Social phenomena influence the processes of economic development and therefore the problem of marginalization and social exclusion is important. Marginalization, indirectly caused by social inequality and stratification, is caused by many factors. The important ones include: problems with finding a job, poverty, alcoholism, drug addiction, homelessness, and the problem of dysfunctionality and disability. Marginalization is also associated with exile, isolating the individual from their original ethnic communities, language and culture, and thus excluding him from the current society in which he finds himself and not being accepted by the current environment. Moreover, this phenomenon concerns the inability to benefit from social life. Marginalization is quite often considered as a form of social exclusion or it is generally equated with it. It applies to individual people, families and groups of

people who live in difficult economic conditions (material poverty), and who are affected by unfavorable social processes resulting from massive and dynamic development changes, for example deindustrialization, crises, sudden collapse of industries or collapse of economic development in their regions. Such people have not been equipped with life capital enabling them to have a normal social position, an appropriate level of professional qualifications to enter the labor market or to start a family, which additionally makes it difficult for them to adapt to the changing social and economic conditions.

Marginalization is the process of pushing a specific group or groups of people to the margins of society, preventing them from actively engaging in various spheres of activity, limiting their identity or place in the community. Through direct and indirect processes, marginalized groups of people may be pushed to the background of the social structure or made to feel as if they are less important than those with more power or privilege in society. Individuals and groups may be marginalized on the basis of many aspects of their identity, including but not limited to: racial identity, gender, capability, sexual orientation, socioeconomic status, sex (gender), age, and/or religion. Some individuals identify with multiple marginalized groups and may experience further marginalization as a result of this.

While exclusion and marginalization are terms that are often used interchangeably, these terms have different meanings. Marginalization refers to the set of processes by which some individuals and groups experience systematic disadvantages in their interactions with dominant social, political and economic institutions. These disadvantages arise from class status, social group identity (kinship, ethnicity, caste and race), political affiliation, sex (gender), age and disability.

Exclusion, when it is not synonymous with marginalization, describes the effects of marginalization. Examples include political under-representation, poor access to legal help and the denial of usage of public services.

In Poland, the following are considered as being excluded:

People at risk of -or experiencing- poverty or social exclusion, including in particular:

(a) people without a constant job,
(b) the unemployed—(only persons belonging to the third group of persons profiled as people away from the labor market within the meaning of Art. 33 of the Act of 20 April 2004 on employment promotion and labor market institutions),
(c) people with low work qualifications,
(d) people with disabilities (including mental disorders),
(e) excluded children and adolescents (or those at risk of social exclusion),
(f) homeless people,
(g) people in the direct environment of socially excluded people (including families of excluded people or people at risk of poverty and social exclusion), whose participation in the project is necessary for effective support of people at risk of poverty or social exclusion.

On the other hand, marginalized communities are residents—especially children, who live in a negative loop that perpetuates non-developmental life patterns, and creates a culture of poverty and life helplessness, which is then transferred onto the next generations.

The main barriers that prevent this group from changing their social status include:

- lack of financial resources
- lack of participation in developmental, educational and cultural activities,
- life and social burnout,
- low self-esteem,
- the feeling of lack of competence.

Marginalized communities, if they are not immersed in apathy and inertia, think about changing their fate in a magical way (e.g., winning the National Lottery) or dreaming of moving to another region or country.

Active social inclusion of marginalized people is carried out with the use of a wide range of professional activation instruments:

– participation in Social Integration Center classes,
– apprenticeship or internship in a Social Cooperative Institution or in another social entity or in an enterprise (work company),
– financing the services of a job trainer or career counselor or by job placement,
– educational means (financing school activities related to completing primary, junior high, post-secondary education and related costs),
– lifelong learning classes aimed at obtaining a profession or vocational preparation, and financing classes as part of raising key professional competences or acquiring new competences and professional skills enabling professional activation, organizing and financing the support of educational activation services, (e.g., an educational broker),
– financing the costs of education or studies for people leaving care and educational institutions or other forms of foster, social and health care,
– social (organizing and financing of social competence and skills training, specialist counseling, as well as providing information on rights and entitlements aimed at restoring life independence, including the return to the labor market),
– individual and group counseling and support in the field of increasing life competences and social and professional skills enabling ultimately the return to social life, including the return to the labor market and professional activation,
– social and health help (financing of psychological, family or psychosocial therapy for individual people or whole families; financing a correctional and educational program for people causing or under the influence of domestic violence, counteracting domestic violence),
– financing a psycho-therapy program in a drug addiction treatment facility in the case of alcohol addicts, within the meaning of the provisions on upbringing in sobriety and counteracting alcoholism; financing a therapeutic program in a health care institution for people addicted to drugs or other intoxicants, within

the meaning of the regulations on counteracting drug addiction) (Active Social Inclusion Act 2016).

Marginalization can have a negative impact on the mental, emotional and physical health of marginalized people. Some possible psychological and emotional responses to marginalization include: anger, anxiety, paranoia, fear, depression, sadness, hopelessness, powerlessness, self-doubt, isolation (Bauer 2015).

People who experience marginalization are less involved in the economy. Their sources of income are different; for most marginalized people their sources of income depend on cash benefits.

Marginality is an experience that affects millions of people around the world. Marginalized people have relatively little control over their own lives and the resources available to them. The result is that they are handicapped in contributing to society. A vicious circle arises in which the lack of positive and supportive relationships means that they cannot participate in local life, which in turn leads to further isolation. This has a huge impact on the development of people as well as the entire society. As the goal of development is to create an environment where people can enjoy a productive, healthy and creative life, tackling marginalization is important. Development is always broadly understood in terms of mass participation. Marginalization deprives the vast majority of people around the world from participating in development.

Economic science should therefore be particularly well prepared to help these people respond to the challenge of their marginalization in a constructive way.

3 Social Behavior in the Context of Epigenetics

Modern neuroscience offers great opportunities to study the relationship between biological and social processes. Therefore, it is not surprising that economists have also become interested in this topic. But does an "ordinary" economist need to know and use theories and techniques related to neuroscience? Do they help to advance economic theory and make better economic decisions? Do they let you see something not available by other means? Today, this theory can be confirmed with certainty. Contemporary research proves that epigenetics can shape a person's personality, and thus his behavior.

Epigenetics is a new branch of genetics and biomedicine, thanks to which it was discovered that also the second code of our genetics empowers our genotype. Epigenetics proves that man is not a slave of his own genes, which can be modified by a healthy life, physical activity and a proper diet. The most important thesis of epigenetics is the fact that the first code (i.e., the first strand of our DNA) doesn't determine everything. For there is another biological information system to which each cell in our bodies owes its knowledge of where it comes from, what it has lived through, and where it is going. It turns out that stimuli, such as: upbringing, love, food, hunger, stress, poisoning, nicotine, hormones, experiences in the womb,

psychological therapies, trauma, torture, climate or sport can change the cell biochemistry without violating the genetic code. Moreover, cells collect a variety of molecular and biological information that is not in the genotype, but it occurs during cell division, when the body cells are transferred to daughter cells along with the genetic material. Therefore, the question of what features we inherited from our ancestors, and which we obtained through upbringing, culture and interactions in our environment, cease to be relevant in this form. The theory of evolution must be rewritten in its significant fragments. Contemporary scientific findings prove that epigenetically accumulated environmental influences are, however, hereditary (Spork 2011).

If the environment plays a role in changing our epigenomes, then a connection can be created between biological and social processes, which absolutely changes our previous perception of life (Szyf 2008). As it turned out, lifestyle influences epigenetic regulation mechanisms. To put it simply, epigenetics is the process that allows you to turn individual pieces of the genetic code on and off, changing their impact on a person's life.

For example, regular physical activity affects our DNA. Based on recent scientific reports, it can be stated with full responsibility that physical effort is "deeply rooted" in genes, influencing a number of epigenetic changes in gene expression, positively affecting health (Lindholm et al. 2014, 1557–1569, Głowacki 2020).

For some time now, there have been more and more scientific publications on the impact of negative emotional experiences on genetic material, which is especially important in the context of marginalized groups. Some information in the DNA strand (called the gene) may or may not show up. And it is stress that determines whether this will happen or not (Unternaehrer et al. 2012). This is confirmed by research on people who survived the Holocaust (Yehuda et al. 2016), who had a difficult childhood (Kumsta et al. 2016), grew up in poverty, experienced severe hunger (Swartz et al. 2016).

Therefore, it can be assumed that the systemic transformation, which caused enormous social costs, could also be a factor influencing the shaping of attitudes and behavior of those people who were most affected by the processes of the ongoing changes. Only a few epigenetic research case studies were mentioned above, but they more and more often confirm that a change in a person's lifestyle affects the health and psyche of their children and grandchildren. The memory of the environment encoded by cells is passed on to the next generations.

4 Decision Making in the Context of Contemporary Research

Correctly used methods of neuroscience help to understand more deeply and broadly the mechanisms of many behaviors. In the light of neuroscience, the key concept is neuroplasticity of the brain and the inheritance of the so-called "the second code"

that epigenetics deals with. Starting with neuroplasticity. Marian Diamond is one of the founders of modern neurobiology, she researched the issues of neuroplasticity and brain enrichment, which challenged the previous knowledge about the brain and genetics, the invariability of the brain's potential. The most important conclusion from these studies is that the brain is not determined by genetics, but it is influenced by the environment. The most important factors of the positive influence of the environment on the development of the brain are: proper diet, exercise, overcoming difficulties, novelty, education, hunger, psychotherapy, as well as care and love (Diamond 2016). This factor is especially important in critical periods of human development, when our beliefs about ourselves and the world as well as our own agency are still forming, when we ask ourselves: "what can we do and achieve and what can't we do?", "how to live?" In dysfunctional environments, the child receives a package of negative experiences (which will be discussed later), and this also causes changes in the brain as a result of traumatic experiences. These changes are caused by over-activation of the hormones adrenaline and noradrenaline (norepinephrine). Constant stress causes these hormones to become overactive, and causes structural changes to the neurons, and changes to the genes. One of the most important neurotransmitters is *serotonin* which modulates all human emotions. Too low levels of serotonin, and high levels of norepinephrine (noradrenaline) cause aggressive and violent behavior. Also, too low levels of norepinephrine (noradrenaline) are the cause of risky, impulsive and affect-filled behavior, alcoholism, and depression. The level of serotonin and norepinephrine is influenced, among others, by parental alcoholism or drug addiction, as well as steroid use. Aggressive behavior is also caused by lead poisoning, which upsets the body's chemical balance. In families with higher rates of violence, the enzyme monoamine oxidase A (the "aggression" gene) has been detected. This enzyme is only disclosed in the male population. Nowadays, science can partially balance the chemistry of the brain, and especially increase the level of serotonin.

Thus, the traumatic experiences of a child in early development can affect serotonin and norepinephrine levels, physical and mental development are also disrupted by the parents' drugs and alcohol consumption—and this shapes the individual's early behavioral matrix.

Other factors influencing the mental and physical development of a person are: malnutrition and improper diet as well as poisoning (e.g., with lead and mercury). Unfortunately, most children today are overfed and malnourished at the same time. The brain is particularly malnourished. Modern food, especially the cheapest (most often consumed by marginalized groups) has very low nutritional values. In experiments conducted by M. Taraszkiewicz with school-age children who were characterized by hyperactivity, violent behavior and learning difficulties. In cooperation with their parents, a monthly "life diet" plan was used, which consisted of:

1. Giving up food such as fast food, sweets, crisps, Cola-Cola drinks and other highly processed foods with low nutritional value.
2. Moreover, parents were asked to give their children drinking water
3. 15-min reading together. (Parents were instructed accordingly about the reading).

The students, on the other hand, took part in 30-h workshops aimed at reconstructing their unfavorable experiences. The effects were amazingly good. The group of students labeled "worst class at school", after a month of interaction, was considered active, calm and competent and changed for the better.

Similar effects were observed in a large group of students (approx. 20,000 children) who participated in the projects: "I can learn" and "I can. I know. I can do it "(in 2007–2013) (M. Taraszkiewicz, POKL 2019). These projects involved students with severe learning and behavioral difficulties. After 40 h of specially designed experiments—the expected change was almost 100%. Changes have happened to students, teachers and parents alike.

In this case, the method of transformation of beliefs and reconstruction/supplementation of missing competences not only related to learning skills, but also elevated the levels of self-confidence, self-belief, sense of agency and self-esteem.

Research shows that breakthrough experiences have the strongest impact on change. Experiences changing the well-established image of oneself and the world, e.g., a change from "I am weak, I can't do anything" to "I know and I can, I'm good, I'm OK." Or from a viewpoint: "life is a jungle where you have to fight to survive", to "the world is generally friendly and I can deal with problems." Or: "school; teachers … it's not for me! I'm good for nothing!", to"I'm important and competent".

The experience of a "better self" is a turning point. Such experiences were experienced, for example, by women serving sentences in prison. With the help of art therapy, repressed emotions and attitudes were reached inside of them and new perspectives of themselves were built. One of the ways was to participate in a make-up workshop. Women with the participation of beauticians, hairdressers and stylists were shown their new images. For many of them it was a breakthrough that changed their life decisions towards better prospects.

A very interesting experiment was carried out by M. Lippman (2008) in schools in one of New York districts. Life in this New York neighborhood is characterized by poverty, violence, gangs and hopelessness. Lipman taught students to think in terms of cause and effect, logic, researching one's own belief, etc., using the tools of basic philosophy and logic deduction. The changes were spectacular!

As it can be seen, helping marginalized and disadvantaged groups of people using the methodology of interactions (resulting from neurosciences and epigenetics) consists of a significant reconstruction of acquired experiences, thus changing beliefs and equipping these people with new competences that start to include them into a new and positive current of events. It also changes their lifestyle.

Only such deep interactions make it possible, strictly speaking, to break out of the loop of negative experiences acquired in childhood and in the environment in which these people grew up or had lived. Only such interactions affect the permanent changes in the brain, and thus the emergence of new functional formats of behavior. Nobody wants to be excluded from the world they live in.

Social assistance in the form of vouchers for free lunches, clothes or a monthly allowance only perpetuates helplessness, creating an additional addiction—the sole dependence on social assistance.

J. Bauer in his book "The Limit of Pain" wrote that the government that does not give its citizens and parents sufficient opportunities for intensive care of their children early in life, later pays a high price—in the form of an increase in mental disorders, in particular depressive disorders and other stress-induced diseases (Bauer 2015).

5 Conclusions

"There are many indications that children born in families with a low socio-economic status drew a shorter match" (Asbury and Plomin 2017). Unfortunately, this generally strongly affects their fate. Professor Heckman, a Nobel laureate at the University of Chicago Economic states, firstly: investing in children from disadvantaged families is a rare and excellent public initiative, promoting equal treatment and social justice while supporting the productivity of the economy and society as a whole (Heckman 2006). Moreover, it is best done in early childhood. The interplay of genotype and environment influences the brain architecture and skill development. Which means that the interplay of genes and experiences plays a role in the developing brain, which is extremely malleable and particularly sensitive to environmental influences in early childhood.

Secondly, the acquisition of skills is subject to hierarchical rules. You must first master the basic skills before moving on to the next level.

Thirdly, skills are interdependent and influenced by experience.

Fourthly, there are periods of increased sensitivity when the brain is at its most plastic state.

Heckman's four assumptions fit perfectly with the results of behavioral genetics research showing that the influences of the community are of greatest importance in the preschool period. "On average, genes explain about half of the individual differences in cognition skills. The environment and upbringing are responsible for the other half".

While socio-economic status is a predictor of school achievement and it is influenced by genes, developing interventions that address the environmental impact of poverty, reduced stimulation, overpopulation, and chaos is the best path to take if equalization is indeed the goal. Problems cannot be solved by acting on the level at which they manifest themselves.

Based on the above, the author of the chapter believes that:

- co-financing poverty only perpetuates incorrect patterns of behavior and beliefs, thereby perpetuating the phenomenon which should be worked out and solved,
- the instrument of change is properly profiled education and appropriately designed educational programs—there is a strong need for revitalized education,
- To this end, educational genetics should form a fundamental part of all training programs for teachers and social welfare workers and politicians, as well as for doctors and perinatal care professionals.

- solving social problems with the help of financial and material aid is "wishful thinking", strengthening characteristic attitudes, beliefs and values that are anti-developmental,
- there is the need to educate specialists in the field of revitalization activities in the field of education and the development of intervention programs (using conclusions from research in the area of neurosciences and epigenetics), the aim of which is to cause a permanent change in disadvantaged and socially excluded people/groups.

In the long run, this will prove beneficial both socially and economically for individuals and the society as a whole.

Regarding decision making, epigenetics teaches that:

– Whoever invests in education also supports the health and learning capacity of future generations.
– Whoever in a targeted way improves the situation of future parents, newborns and young children, does something beneficial for the later education of children and adolescents.
– Investment in education starts with fighting poverty and inequality.

In this chapter, the author tried to show that the biological approach has much to offer economists and decision-makers. Well-interpreted research using neuroscience methods may not only contribute to a deeper, multi-disciplinary understanding of social phenomena, but also positively influence the development of theories in this discipline.

The presented issues confirm the author's belief that making decisions in the field of human resource management can be considered in terms of economic conditions (labor demand/supply), but also in neural aspects, examining human internal mechanisms and drawing conclusions about individual "differences" between people. Knowledge about the neural aspects of trust, empathy, and the role of the brain seems to be important in a world where the concept of managing people is accused of being manipulative.

The presented latest research in the field of epigenetics (extra-gene inheritance)—according to which there is a second code of inheritance of our behavior, the perception of the image of the world, and therefore also of our mentality and life attitudes, allows to partially explain the multigenerational inheritance of social inertia, helplessness, antisocial attitudes, i.e., inheriting negative and non-developmental life patterns and attitudes. Traditional education at school is not able to eliminate these negative patterns; on the contrary, it perpetuates social stratification and does not give future generations any chances for a better change.

There is a need for effective programs changing the mentality and building resourcefulness in life in the youngest inhabitants, as well as for programs for young parents (shaping the mentality) of the young generation and for programs for intergenerational integration.

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A Synthetic and Holistic Approach of the Non-performing Loans: From the Creation to the Solution

Paris Patsis, Konstantinos Liapis, and Christos Galanos

Abstract In international literature, the problem of non-performing loans is treated as a problem that arises exogenously. The efforts of the academic community and professionals in the industry are to approach non-performing loans as a problem for banks and not for businesses. While business administration, accounting, and administrative accounting as well as loan financial engineering provide techniques and suggestions, they remain fragmentary. The purpose of this chapter is to investigate the problem of non-performing loans as well as to develop proposals and methods for solving it.

The present chapter approaches its subject from the point of view of business administration, accounting, finance and financial engineering, while banking is only involved in the issues of securitization, where this is also considered in the interest of the investor.

To quantitatively investigate the problem, econometric tools and advanced methods of business research were used.

For the purposes of the research, real data were used by companies and also by the banking system in the case of securitization of non-performing loans, while generalized case studies have also been created.

The contribution of this chapter lies in approaching the problem exclusively within the scientific framework that it has set, and this is its originality. Also, original, and innovative solutions were provided to address the problem such as securitization and personalized business solutions. The original models and the innovative quantitative applications have undeniable academic value and are methods of good practice.

P. Patsis (✉) · K. Liapis · C. Galanos
Panteion University of Athens, Athens, Greece
e-mail: p_patsis@panteion.gr; Konstantinos.liapis@panteion.gr

K. Nermend et al. (eds.), *Decision-Making in Management*, Contributions to Management Science, https://doi.org/10.1007/978-3-030-67020-7_7

Keywords Accounting · Business administration · Finance · Banking · Financial engineering and business research

JEL Classification Codes M41 · G21 · M10 · C44

1 Introduction

This chapter is aimed at investigating methods and policies of business remediation with emphasis on non-performing loans that have arisen due to the economic crisis. At the same time, it cannot leave out the theoretical investigation of the methods already established in the literature, proposing methods, procedures and at the same time investigating the factors influencing the NPLs, thereby making an overall contribution to the academic dialogue on specific issues. The approach adopted is initially to investigate the factors that affect NPLs, and then proceeded to analyze, through modeling, the financial engineering of loans. The chapter continues by making reference to complex methods of dealing with NPLs through securitization while investigating the process of securitization. Also, all the methods that can contribute to the solution of the problem of NPLs are investigated with the critical thinking process in mind.

The purpose of this chapter to study the way of shaping and critically investigating the methods of dealing with NPLs both on the part of borrowers and on the part of companies, contributing to the academic dialogue and proposing innovative techniques. The chapter has considered the fact that dealing with NPLs is vital for the Greek economy, so that credit institutions can re-finance the economy and can ultimately lead to growth. The only reason for the above-mentioned orientation of the research is the desire of the researcher that the paper be not only of scientific competence but also of practical interest.

The chapter is oriented towards the following:

The use of econometric methods for the analysis of the factors that affect the evolution of NPLs.

The processes leading to the optimal selection of the technical characteristics of loans when obtaining or negotiating a loan; also, the way in which these processes ultimately affect the borrower by changing the service obligations and reducing the total charge.

The financial statements of a company facing liquidity problems due to its loan obligations; it is examined how this company can cope with the loan, by means of an optimal negotiation and deleveraging of its assets.

The securitization process and how through securitization a credit institution can rid itself of a large volume of loans, either directly or synthetically; also, how an investor can collect his money with the desired return for him, with reference to the collectability rate stipulated by the portfolio.

The control of the economy and the efficiency of the methods of dealing with NPLs has been a popular subject of analysis in multiple fields, such as Financial Management, Banking, Accounting, Managerial Accounting and Financial Analysis. The debate has been based, over time, on the international literature as well as in practical applications with the aid of statistics, econometrics and operation research techniques. In this way, a relationship of interdependence of theoretical and quantitative approaches has been developed; the present chapter is aimed at addressing these in an innovative and original way.

2 Research Justification

The need to deal with non-performing loans has been an issue of great concern to the academic community, industry professionals, banks, regulators, the economy in general and societies over the recent years. Especially after the recent financial crisis and the debt crisis of the Greek economy that hit the credit systems and many economies worldwide, this need to investigate the above issue has become even more urgent.

On one hand, burdened with NPLs on their assets and forced to comply with the stringent requirements of supervisory funds, credit institutions are not able to adequately finance the economy. As a result, the economy becomes stagnant and underdeveloped.

On the other hand, having faced significant liquidity and profitability problems since the outbreak of the global financial crisis and without the help of banks to refinance their operations, businesses have entered a state of suffocation and lack of liquidity.

The two above-mentioned reasons render the issue of dealing with NPLs vital, not only for businesses, but also for credit institutions and, therefore, for the economy as a whole. Hence, the need for a chapter (study) in the specific scientific subjects that the specific scientific work is trying to cure is deemed indispensable.

3 Main Question

The first sub question to be answered is “what are the macroeconomic and microeconomic factors that interact, affecting NPLs?” And once identified, how can they contribute to tackling the problem of these loans?

From the above sub question, a parallel main question arises in the second part of the original question and from a microeconomic point of view “what can govern the decision to choose an appropriate way to settle such loans when there is a vast array to choose from?”

In the course of the present chapter and with regard to the parallel question, additional main questions emerged, which, are answered in the following order (as they appear in the chapter):

- Is it possible to create a single template where the main variables affecting profitability can be prioritized, just by entering the historical background of any given company?
- How are loan charges and the cost of performing loans calculated when making business decisions?
- Finally, the same chapter answers and analyzes the question of whether and how a company's profitability is affected by the regulation of its loans and whether other policies, such as that of deleveraging, can be adopted.

Finally, after answering the above main questions clearly and adequately, the chapter turns to the question "can NPLs be dealt with through a process of securitization, as a global solution of the problem by the banks and not only by retail loan arrangements?"

4 Literature Review

In recent years, and since 2007, the economic crisis has made its appearance in most European countries. The economic crisis was accompanied by the rapid increase in non-performing loans, which created several problems for the Banks. As (Tsakalotos 1989) mentioned "decisions on extending bank credit were frequently made based on non-banking criteria such as "personal contacts and social pressure" which lead to inefficiency regarding risk management and to problems with NPLs. For this reason, many writers have dealt with non-performing loans on the academic level, mainly by exploring the variables that affect them. In addition, NPLs are important since they can be used as an indicator of the onset of a banking crisis (Reinhart and Rogoff 2010).

Most of the studies have focused on investigating and establishing how macroeconomic variables affect the evolution of the NPLs. Klein (2013) focused on CESEE countries (Central, Easters and South-Eastern Europe), where NPLs were found to respond to macroeconomic conditions, such as GDP growth, unemployment, and inflation. The analysis also indicates that there are strong feedback effects from the banking system to the real economy, thus suggesting that the high NPLs that many CESEE countries currently face adversely affect the pace of the economic recovery. At the same time (Tanasković and Jandrić 2015), investigated CEEC (Central Eastern European Countries) and SEE (South Eastern Europe) countries, proving that there is a negative relationship between increases in GDP and rise of the NPL ratio. Along with GDP, foreign currency loans ratio and level of exchange rate are positively related with the increase of NPL ratio. This confirms the expectation that countries where domestic currency is not the main medium of credit placements will have larger problems with the level of NPLs, which is even more

pronounced in periods of domestic currency depreciation. A paper by (Škarica 2014) in selected emerging markets for seven CEEC countries suggested that the primary cause of high levels of NPLs is the economic slowdown, which is evident from statistically significant and economically large coefficients on GDP, unemployment, and the inflation rate. Messai and Jouini (2013) studied the NPL's Micro and Macro determinants for the Banking Sectors of Italy, Spain and Greece. This study showed that the problem loans vary negatively with the growth rate of GDP, the profitability of banks' assets and positively with the unemployment rate, the loan loss reserves to total loans and the real interest rate. Rinaldi and Sanchis-Arellano (2006) analyzed household NPLs for some European countries and found that disposable income, unemployment and monetary conditions have a strong impact on NPLs, while (Berge and Boye 2007) found that real interest rates and unemployment have a strong impact to NPLs. In addition (Khemraj and Pasha 2009; Fofack 2005) also found a negative correlation between NPL and GDP. Similar studies focusing on Macroeconomic determinantsim include (Nkusu 2011; Goodhart et al. 2006; Adebola et al. 2011).

According to the literature, the three main macroeconomic factors that affect the development of NPLs are:

- The GDP: (Louzis, DP et al. 2012; Messai and Jouini 2013; Makri et al. 2014; Klein 2013; Tanasković and Jandrić 2015; Škarica 2014; Espinoza and Prasad 2010; Fofack 2005; Khemraj and Pasha 2009).
- Unemployment: (Louzis, DP et al. 2012; Rinaldi and Sanchis-Arellano 2006; Berge and Boye 2007; Messai and Jouini 2013; Makri et al. 2014; Klein 2013; Škarica 2014).
- Rates (Lending-Interest-Exchange): (Louzis, DP et al. 2012; Berge and Boye 2007; Messai and Jouini 2013; Tanasković and Jandrić 2015; Espinoza and Prasad 2010; Fofack 2005; Khemraj and Pasha 2009; Adebola et al. 2011). The interest rate also affects the amount of bad debt in the case of floating interest rates. This implies that the effect of interest rates should be positive, and therefore, there is an increase in the debt caused by the increase in payments of interest rates and hence on the rise of non-performing loans (Bofondi and Ropele 2011).

Other variables that significantly affect the NPLs are the Industrial Production and Consumer Prices (Adebola et al. 2011), Public Debt (Angelos T. Voulidis 2012; Makri et al. 2014), Monetary Conditions and Disposable Income (Rinaldi and Sanchis-Arellano 2006) and Inflation (Klein 2013; Škarica 2014).

Another part of the literature focuses on specific determinants of banks that affect the NPLs. (Podpiera and Weill 2008) focused on efficiency indicators and NPLs, more specifically on created variables, such as "bad luck", "bad management", "skimping" and "moral hazard". They tested US banks between 1985 and 1994 and concluded that decreases in measured cost-efficiency led to increased NPLs. Podpiera and Weill (2008) continued the research and also produced similar results for Czech Banks between 1994 and 2005, while (Breuer 2006) measured the influence of many institutional variables that may affect the NPLs.

A further part of the literature focuses on the impact of both macroeconomic and bank-specific factors that affect the NPLs. Salas and Saurina (2002) investigated the case of the Spanish Bank for the period between 1985 and 1997, finding evidence that bank-specific determinants affect the NPLs and can be used as early sign indicators. Similar studies include (Clair 1992; Gonzalez-Hermosillo et al. 1997). Louzis et al. (2012) examined the Greek Banking Sector for each loan category separately (consumer loans, business loans and mortgages), and found that macroeconomic variables, GDP growth-unemployment rate-lending rates and public debt have a strong effect on NPLs, while, at the same time, bank specific variables, such as performance and efficiency, possess additional explanatory power when added into the base-line model. Makri et al. (2014) investigated the Eurozone banking system for the period 2000–2008, just before the beginning of the recession. They found strong correlations between NPL and various macroeconomic (public debt, unemployment, annual percentage growth rate of gross domestic product) and bank-specific (capital adequacy ratio, rate of non-performing loans of the previous year and return on equity) factors. Ghosh (2015) found that greater capitalization, liquidity risks, poor credit quality, greater cost inefficiency and banking industry size can lead to significant increase in NPLs, while greater bank profitability will lower NPLs. Moreover, higher state real GDP and real personal income growth rates, as well as changes in state housing price index reduce NPLs, while inflation, state unemployment rates and US public debt significantly increase NPLs. Dimitrios et al. (2016) also examined both macroeconomic and bank specific variables but they were the first to test the effect of the personal income and the output gap in the evolution of NPLs.

In recent years, securitization has become a tool of major significance when dealing with NPLs. However, literature on the subject of securitization dated back years ago. In 1991 (Donahoo and Shaffer 1991) published their research focusing on the question of whether capital requirements affect a company's decision to carry out securitization or not. The dynamics of the company in the market and the nature of the capital requirement seem to be key factors towards this decision. In 1994, in his article "The Alchemy of Asset Securitization," (Schwarcz 1994) gives us a detailed picture of securitization and presents the ways in which companies can make a profit indirectly or directly from it. In 2008 (Bannier and Hänsel 2008) examined the factors that lead institutions to a decision towards securitization. Their findings show that securitization seems to be a suitable financing tool for large banks with high risk and low liquidity, where risk transfer is limited; at the same time, regulatory arbitrage does not seem to have any effect on their decision. Keys et al. (2009) examined whether regulations governing the process of securitization can reduce the problem of moral hazard arising from it. Their results showed that the implementation of such regulations may, in fact, reduce the moral risk of securitization. In 2008, the "Term Asset-Backed Securities Loan Facility" was established by the United States Federal Reserve, aimed at supporting the securitization market that guaranteed consumer loans. Campbell et al. (2011) studied the effectiveness of this program and concluded that it reduced interest rates for some categories of consumer loan securitization; however, this had minimal effect on the

prices of these securities. The same year saw the publication of their research (Calem et al. 2011) which showed that the miscalculation of the risk involved in securitization played a decisive role in the development of crises and in market collapse. In 2015 (Farruggio & Udhe, 2015), attempted to identify the determinants of securitization in Europe, by examining 75 countries for the period 1997–2010. Their findings showed that these determinants relied heavily on the bank, market and country variables. In addition, it has been observed that these factors change in times of crisis; furthermore, they tend to depend on the underlying element of securitization and the type of the transaction in question.

A similar study was carried out by (Affinito and Tagliaferri 2010) who examined the factors of the securitized bank loans of Italy for 6 years before the 2007 crisis. They concluded that the least profitable and liquidity-lacking banks which possessed more problematic loans, adopted the solution of securitization for larger amounts of money and much sooner compared to other Italian banks. The book entitled "Asset securitization: Theory and practice" published by (Hu 2011) presents the original idea of securitization and its practices. In 2017, a survey of (Black et al. 2017) on whether bank securitization helps to secure personal consumption from financial shocks led to the following conclusion: due to the fact that securitization increases the supply of new loans, it has a positive effect on consumer normalization in times of crisis. A study of similar nature by (Liu and Shao 2013), concluded that the securitization of loans given to small and medium-sized enterprises in the United States can positively affect changes in government revenues in times of crisis; even more importantly, the positive effect is more apparent in societies where small and medium-sized enterprises play a more central role.

Back in 2010 (Keys et al. 2010) conducted a different survey on whether securitization is able to reduce borrowers' control over financial institutions. The survey used data from securitized mortgages and its results demonstrated that, in fact, the incentives of the credit institutions to control borrowers were less strong, so securitization affected the audit negatively. Loutskina and Strahan (2009) have proven that an increase in the secondary market for mortgages, created through securitization, reduces the impact of financial disruptions on credit supply. The survey of (Loutskina 2011), which creates a liquidity index, examined whether securitization might affect liquidity and might lead to an increase in the lending capacity of the banks. The results of the survey indicated that securitization by allowing the bank to convert non-liquid loans into cash is, in fact, conducive to an increase in lending capacity. Nadauld and Weisbach (2012) examined whether business-loan securitization had an impact on corporate debt-pricing and examined the characteristics of loans associated with the probability of securitization. The research concluded that the marginal interest rate on securitized loans was 15 points lower than that of non-securitized loans; also, that loans from securitized banks, rated B and B-, are more likely to be securitized than any other loan. Banks do pay corporate income tax, whereas special-purpose tools for securitization do not. Han et al. (2015) created a model through which they demonstrated that, in the case where a bank receives increased demand for loans which it cannot support, the aforementioned tax asymmetry motivates banks to sell these loans through securitization, despite the fact that

they are under-monitored. Albertazzi et al. (2015) examined the probability of defaulting on securitized loans compared to non-securitized ones; they concluded that securitized loans are less likely to be defaulted than non-securitized one, if specific conditions are present. Following the same hypothesis and based on data from Italian banks (Albertazzi et al. 2015) examined the correlation between securitization and the likelihood of failure, in an attempt to assess whether there is some form of discrepancy present. Their findings show that the negative effects of discrepancy can be counter-balanced by the right choice of loans to be securitized. In a recent survey of 2019, aimed at assessing the effect of securitization on credit quality (Deku et al. 2019) found that banks do not choose low-quality loans for securitization. After securitization, these loans were degraded to a greater extent, in terms of quality, than those included in audit groups, due to lack of monitoring of these borrowers by the bank. Kaya and Masetti (2019), analyzed the impact of securitization of small and medium-sized enterprises with regard to their access to financing within the Eurozone. The results showed that increased securitization reduces not only the likelihood of credit limitations on small and medium-sized enterprises, but also the cost of bank financing. Finally (Deku et al. 2019), investigated whether securitization affects bank behavior and financial stability. In the wake of the crisis, banks with higher credit and market risk were more inclined to securitize; this meant that they were willing to take more risks, as they resorted to securitization in order to receive capital.

5 NPL Determinants

Nowadays, Non-Performing Loans (NPLs) is an issue of great importance. All members involved, BoG, SSM, IMF and ECB, place importance on this matter. The reason is that unless this problem is addressed, Greek Financial Institutions and—at the same time—the Greek economy in general will never manage to overcome the crisis and return to normality. Notwithstanding Greek Banks' efforts to deleverage their assets and the substantial discontinuance in funding the Greek economy, the problem is acute and remains so, while the economy continues to suffocate. Due to the massive outflow of deposits, the implementation of restrictions on capital flows, and the dramatic change in the ratio "deposits to lending", the problem of NPLs has become a liquidity problem for the country's credit system. At this point we will try to investigate the determinants that affect the evolution of the NPLs. First, we collected the Timeseries of NPLs from the BoG for the years 2002 to 2018. This period is very important and highly representative, since it covers a whole economic cycle, the flourishing period from 2003 to 2007, the financial crisis from 2008 to 2017 but also the recovery of the Greek Economy 2018. In addition to that, we also categorized the NPLs in three main categories, Retail Portfolio, Housing Portfolio and Business Portfolio in order to assess whether the same determinants affect each Portfolio category in a different way. From Fig. 1 we observe that the NPLs have demonstrated a sharp and continuous increase from 2008 on, trying to level off over

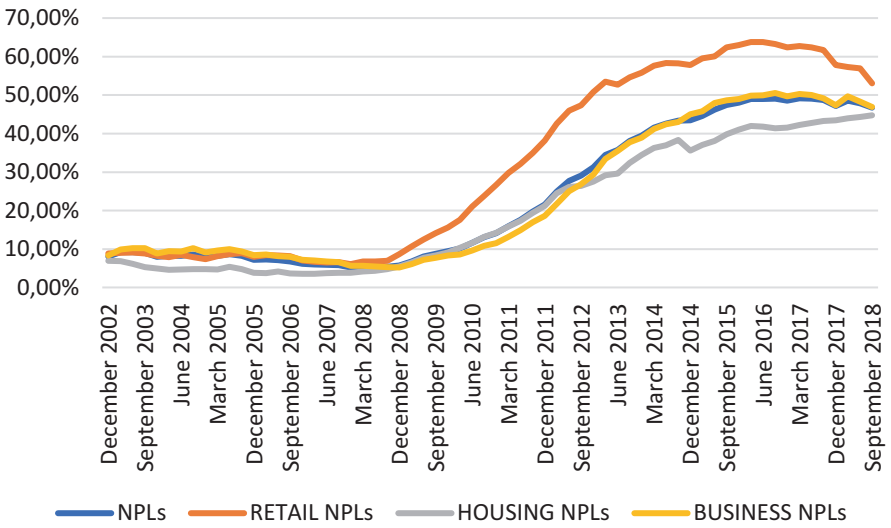


Fig. 1 NPL evolution

the last years (2015 onwards). In addition to that, we observe that the highest percentage of NPLs is demonstrated by the Retail category throughout the whole period, while the other categories remain at relatively similar percentages (Fig. 1).

Using the E Views econometric package, we used Single and Multiple Regression Analysis (OLS regressions), in combination with the HAC (Newey and West n.d.) in order to correct in advance heteroskedasticity and autocorrelation. In our Models we incorporated quarterly data from December 2002 to September 2018. As dependent variables we used NPL ratios for 3 different Portfolios, Business-Retail-Housing and the NPL ratio in total. As independent variables we used Overdue Debts, GDP, Inflation, Unemployment, a dummy variable that incorporates the financial Crisis and Tax in corporate and personal level.

The models which we are going to examine are the following:

Model 1: $NPL_t = Unemployment_t + c + e_t$
Model 2: $NPL_t = Overdue\ Debts_t + c + e_t$
Model 3: $NPL_t = GDP_t + c + e_t$
Model 4: $NPL_t = Inflation_t + c + e_t$
Model 5: $NPL_t = Unemployment_t + Dummy\ Crisis_t + c + e_t$
Model 6: $NPL_t = Unemployment_t + Dummy\ Crisis_t + Personal\ Income\ Tax_t + c + e_t$
Model 7: $NPL_t = Overdue\ Debts_t + GDP_t + Inflation_t + c + e_t$
Model 8: $NPL_t = Overdue\ Debts_t + GDP_t + Inflation_t + Croporate\ Income\ Tax_t + c + e_t$

The estimations of our models are shown in Table 1, where the coefficients of the explanatory variables and the R squared of each model are presented. As expected, Model 1 demonstrates that unemployment affects the NPL ratios in a positive way, meaning that the higher the unemployment is, the higher the NPL ratio will be. It is

Table 1 Econometric results

Independent variables:	Model 1	Model 2	Model 3	Model 4	Model 5	Model 6	Model 7	Model 8
Dependent variable:	*NPLs*							
Overdue debts		6.43E-12***					5119,054***	4761,459***
GDP			−2126,274***				−347,366***	−783,735***
Unemployment, total	0.021***				0.020***	0.02***		
Inflation, consumer prices				−0.069***			−0.018***	−0.016***
Dummy crisis					0.007*	−0.005*		
Personal income tax						−0.004*		
Corporate income tax								−0.005***
Constant	−0.121***	0.086***	0.764***	0.349***	−0.12***	−0.079*	0.103***	0.383***
R squared	84%	93%	40%	72%	85%	88%	97%	98%
Dependent Variable:	*Retail NPLs*							
Overdue debts		8.18E-12***					6965,007***	5532,745***
GDP			−2566,703***				−101,325*	−1543,780***
Unemployment, total	0.030***				0.027***	0.026***		
Inflation, consumer prices				−0.092***			−0.028**	−0.024***
Dummy crisis					0.065***	0.054***		
Personal income tax						0.001*		
Corporate income tax								−0.018***
Constant	−0.181***	−0.090***	0.960***	0.475***	−0.172***	−0.183**	0.052*	0.992***
R squared	92%	85%	32%	68%	93%	95%	90%	97%
Dependent variable:	*Business NPLs*							
Overdue debts		6.51E-12***					4942,905***	5001,054***
GDP			−2235,476***				−478,558***	−636,378***
Unemployment, total	0.020***				0.021***	0.021***		
Inflation, consumer prices				−0.071***			−0.02***	−0.017***

Independent variables:	Model 1	Model 2	Model 3	Model 4	Model 5	Model 6	Model 7	Model 8
Dummy crisis					−0.017*	−0.03**		
Personal income tax						−0.005*		
Corporate income tax								−0.002**
Constant	−0.115***	−0.090***	0.792***	0.352***	−0.117***	−0.063*	0.147***	0.237***
R squared	80%	93%	45%	73%	80%	84%	98%	97%
Dependent variable:	*Housing NPLs*							
Overdue debts		5.81E-12***					499,392***	4204,656***
GDP			−1763,122***				−137,486*	−763,905***
Unemployment, total	0.018***				0.017***	0.016***		
Inflation, consumer prices				−0.060***			−0.013**	−0.011**
Dummy crisis					0.038**	0.027***		
Personal income tax						−0.002*		
Corporate income tax								−0.008***
Constant	−0.118***	0.088***	0.638***	0.299***	−0.113***	−0.091*	0.011*	0.43***
R squared	86%	94%	35%	68%	87%	91%	95%	97%

Notes: The number of stars (*) denote significance level: ***p-value < 0.01, **p-value < 0.05 and *p-value < 0.1

very interesting to note that unemployment affects more the Retail Portfolio. This is something we expected since unemployment affects more the people that have access to retail loans. This is also the model with the higher R squared, with a percentage of 92%. According to Model 2, overdue debts affect the NPL Ratio in a positive way, meaning that the higher the overdue debts are, the higher the NPL ratio will be. This is something we also expected: since people cannot meet their obligation to the state, at the same time they will probably not meet their obligations to the banks, either. In addition, the portfolio that is affected more by the overdue debts is the Retail one, which is also to be expected. According to Model 3, GDP affects the NPL ratio in a negative way. This is also explicable since higher GDP leads to more wealth in the economy, making it easier for businesses and people to pay for their loans. Here we expected that the Business Portfolio would be the one that is more affected by the changes in GDP. Instead, it was the Retail Portfolio. Model 4 demonstrates that inflation affects the NPLs negatively, since NPLs have been created monetary in past years and they bare no interest. With high price levels the monetary value of the NPLs is devaluated and thus we have a negative relation. Moreover, inflation makes easier the payment of NPLs with inflated money. This has to do with the accounting principle of the "stable dollar". A very important note here is that in the first four models, all the coefficients are statistically significant with 99% significance interval. From model 5 to model 8 we used multiple regression analysis in order to try to combine more independent variables in one regression. In model 6 we combined unemployment and a dummy variable. This dummy variable represents crisis and takes the value of 1 in periods when the Greek economy faced crisis and 0 in periods when the Greek economy didn't face a crisis. From the regressions estimated, we can see that the only regression whose coefficients are all statistically significant is the one that has the Retail Portfolio as a dependent variable. This is also the regression that has the higher R squared of 93%. This is something we expected, since both Unemployment and Crisis are determinants that affect the individuals that have access to retail loans. In model 6, we used the same regression as in model 5, but also incorporated the Personal Income tax in order to find out how personal income tax contributes to the NPL ratios. In all NPL Portfolios, the determinant of Personal Income Tax is not statistically significant. In Model 7, we combined the independent variables, Overdue Debts, GDP and Inflation. For the Retail and Housing Portfolio, GDP and Inflation are not statistically significant, whereas for the NPL Portfolio and the Business portfolio all the independent variables are. Then we used the same independent variables and added the corporate income tax. In this case, all the coefficients are statistically significant with a significance interval of 5%. Finally, using pooled data analysis for the variable loans to deposits for the four systemic banking groups, we concluded by analyzing the cross fixed effect that the bank that handled better the liquidity crisis in the Greek economy was Alpha Bank while the bank with the worst performance was National Bank of Greece.

6 Loan Financial Engineering

The purpose of this paragraph in this chapter is to present an automated model that will produce a loan repayment table after the user enters the characteristics of the loan he wants and then it will produce both the total interest and the total installments required for the full repayment of the loan. The aim is for the user to be able to distinguish according to the assumptions he makes in the loan, the effect that these assumptions will have on the total interest and installments that the borrower will be asked to pay. More specifically, as input variables the model accepts the total loan amount, interest rate, loan duration, the loan initial date, payments per year, grace period, Ballon payment amount expressed as a percentage of the total loan as well as and the type of loan. After all the input variables are entered, the loan repayment table is automatically generated (Table 2).

The three types of loans are presented below:

1. Bond loans with coupons

   In this type of loan the borrower pays in each agreed time period only the interest of the loan while at the end of the loan he pays the total capital as well as any interest that has been capitalized in case we have a grace period. When we have a grace period, the interest of that period is capitalized and increases the balance of the loan. The interest in each time period is calculated by multiplying the effective rate of the period by the balance of the loan. As long as we have a grace period the interest is capitalized and the balance of the loan increases, hence the next interest payment. When the grace period expires, then the balance of the loan remains fixed as no interest is capitalized, so the payment of interest from now until the maturity of the loan is fixed. In this type of loan the Ballon does not make sense as the borrower pays only interest anyway and the entire principal is paid at the end of the period
2. Sinking fund loans with equal instalments

   In this type of loan the borrower pays a fixed installment throughout the duration of the loan, while in case there is a Ballon payment, it is added at the end together with the last installment of the loan. A feature of this loan is that as we

Table 2 Input variables table

Loan characteristics	Loan amount	1.000.000 €
	Interest rate	3%
	Loan duration	10
	Initial date of loan	1/1/2020
	Payments per year	2
	Grace period	2
	Ballon amount	10%
	Type of loan	2
	Bond loans with coupons	1
	Sinking find loans with equal installments	2
	Equal per period amortized loans	3

move towards the maturity of the loan the interest rate on the total installment decreases while the interest rate on the capital increases. This means that in the beginning we pay most of the interest while in the end we pay most of the capital. The instalment is calculated by the following formula:

$$\text{Instalment} = C * \frac{\left(\frac{i}{m}\right)}{\left(1-\left(1+\frac{i}{m}\right)^{-k}\right)}$$

Where:

$$\text{C} = \text{Principal} + \text{Interest that have been capitalized} - \text{Ballon}$$

$$\text{i} = \text{interest rate}$$

$$\text{m} = \text{payments per year}$$

$$\text{K} = \text{number of instalments}$$

Then the interest is calculated by multiplying the effective rate by the balance of the loan while the amortization of each period is the difference between the installment and the interest of the period.

3. Equal per period amortized loans

In this type of loan the borrower pays a different installment in each time period, only in the installment he pays each time the principal paid remains fixed while the interest is not, therefore the total installment changes over time. While the loan is repaid, the interest rate decreases and since the payment remains stable, the installment also decreases, so in this type of loan the two main characteristics are that the principal paid remains constant while the installment decreases over time. The payment is calculated by the following formula:

$$\text{Installment} = \frac{C}{K}$$

Where:

$$\text{C} = \text{Principal} + \text{Interest that may have been capitalized} - \text{Ballon}$$

$$\text{K} = \text{number of payments}$$

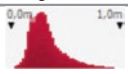
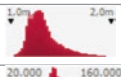
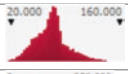
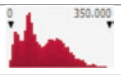
In the quantitative analysis that follows we will proceed to the stress of the model under conditions of uncertainty in order to see which variables and how they affect both the total interest and the total installments. In addition, we will look at the effect on the first 3 years of the loan in order to see the effect on the immediate liquidity of a business, which is very important for companies that negotiate loans and have a Long term business plan but with short term liquidity difficulties.

Table 3 shows the input variables that we will stress to see how the total interest and installments are affected.

Table 3 Financial engineering input table

Name	Cell	Graph	Min	Mean	Max
Interest rate	B3		1%	3%	5%
Loan duration	B4		10	14.5	19
Payments per year	B6		1	2.5	4
Grace period	B7		0	1	2
Type of loan	B10		1	2	3
Ballon	C8		0%	25%	50%

Table 4 Financial engineering output table

Name	Cell	Graph	Min	Mean	Max
Total interest	F125		79.00712	344.81790	929.69680
Total instalments	H125		1.079.00700	1.344.81800	1.929.69700
Total interest 3Y	L125		22.69747	73.92107	140.61180
Total instalments 3Y	M125		11.56807	117.73730	329.58440

Initially, the first input variable that the survey will introduce to the model is the interest rate, with a minimum of 1% and a maximum of 8%, following the Pert distribution. The second variable is the duration per year where it is distinct with values from 10 years up to 19 years. The third variable is the payments per year with a minimum of 1 and a maximum of 4, where here too the distribution we have chosen is distinct as this variable can only take integer values. Respectively, we chose a distinct distribution both for the grace period with a minimum price of 0 years and a maximum of 2, as well as for the type of loan that we have here, as we described earlier, three types of loans. Finally, we have as the last input variable the Ballon where we selected Pert distribution with a minimum of 0% and a maximum of 50%. The limits we have chosen represent the real conditions and practices that prevail in the market.

The analysis performed contains four stages. We first checked the effect of the above variables on the total interest, and then on the total installemnts. In the last two stages we checked the effect on the total interest of the first 3 years and respectively on the total installments of the first 3 years. Table 4 provides a brief overview of the research results.

Fig. 2 Hierarchy output results

From the above table we see that the total interest in a period of 90% confidence ranges from 185,773 thousand euros to 607,657.7 thousand euros while the total installments range from 1,185,773 million euros to 1,607,658 million euros. Respectively, the total interest of the first 3 years in a period of 90% confidence ranges from 43,971.12 thousand euros to 107,013.8 thousand euros while the total installments of the first 3 years range from 29,796.14 million euros to 228,788.7 million euros.

In the last part of our analysis we tried to see the hierarchy of the factors that affect every variable tested. We concluded as we can observe in the following table that the main factor is the interest rate except for the case of the payments for the 3 years where the main factor is the type of the loan (Fig. 2).

7 Retail Solutions for NPL

The global financial crisis has created financial problems for a wide range of companies. Many of these companies, having strong bank lending, were forced to renegotiate the terms in order to survive. The negotiation of the terms presupposes a Business Plan on the part of the company in order for the counterparty bank to be able to see whether the company will be able to pay its obligations to the bank in the future and on the other hand to see the need to negotiate the loan. In the context of a negotiation, the two important elements are on the one hand the creation of a Business Plan, but also the repayment schedule of the loan with the new terms that will be agreed. Both the Business Plan and the repayment table after the user enters a new interest rate or grace period or Ballon payment etc. have been created by this research.

We will use as variables that will stress the interest rate of the loans (seventh overall in the ranking arrangement and first in the long-term arrangements according to the ECB) and the total loans (tenth overall in the ranking arrangement and fourth in the long-term arrangements according to the ECB-first case).

We will also incorporate deleverage (16th overall in the ranking arrangement and fourth in the final settlement arrangements—voluntary sale of a mortgage—according to the ECB-second case).

As we can observe from the Table 5, in the first case we use as input variables the interest rate, pert distribution with min 1.5% and max 10% and the long-term bonds, also pert distribution with min 400.000 euros and max 750.000 euros. In the second case respectively, we also use the intangible assets as input variable in order to incorporate deleverage in our analysis (Fig. 3).

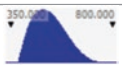
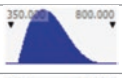
We observe that Cash from Operations t + 1 is between 156,949 and 163,103 euros in a 95% confidence interval. The variable that affects the most is interest rates and not so much the volume of loans. In addition, if we keep the loans stable and let only the interest rate change then the Cash from Operations t + 1 ranges from 156,901 and 163,264 euros (Fig. 4).

We observe that the Earnings before taxes (EBT) between −12.316 and 30.127 euros in a period of 95% confidence. The variable that affects the most is again the interest rates and not so much the volume of loans. In addition, if we keep the loans stable and let only the interest rate change then the Earnings before taxes (EBT) ranges from −12,650 and 31,235 euros.

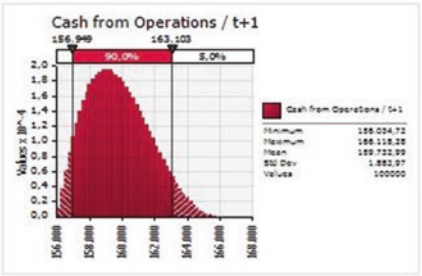
Because as we saw in the previous analysis, the interest rate is more important than the volume of loans, we decided to include leverage in the analysis, for this reason we added to the variables that will stress the tangible fixed assets t + 1 (Fig. 5).

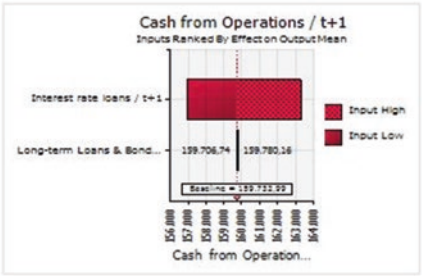
We observe that the Cash from Operations t + 1 moves between 156,690 and 164,191 euros in a period of 95% confidence. The variable that affects the most is

Table 5 Retail management scenarios

Name	Cell	Graph	Min	Mean	Max
1st Case					
Interest rate loans/t+1	C7		−10.00%	−7.02%	−1.5000%
Long-term loans & bonds/t+1	C28		400.000	525.000	750.000
2nd Case					
Interest rate loans/t+1	C7		−10.00%	−7.02%	−1.5000%
Long-term loans & bonds/t+1	C28		400.000	525.000	750.000
Tangible assets/t+1	C20		1.000000	1.533333	1.800000

RISK Output Report for Cash from Operations / t+1 F22

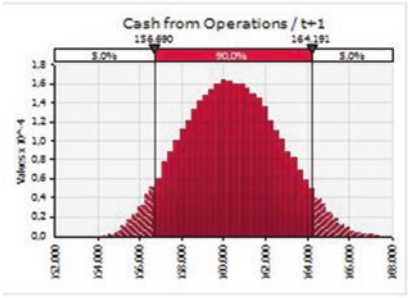


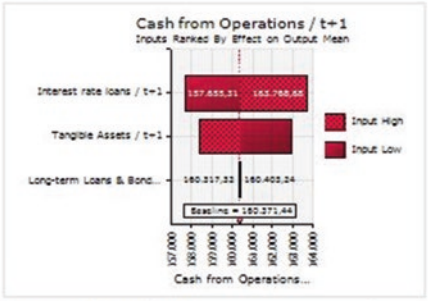


Change in Output Statistic for Cash from Operations / t+1			
Rank	Name	Lower	Upper
1	Interest rate loans / t+1	156.901	163.264
2	Long-term Loans & Bonds / t+1	159.707	159.780

Fig. 3 Risk output cash from operations first case

RISK Output Report for Cash from Operations / t+1 F22





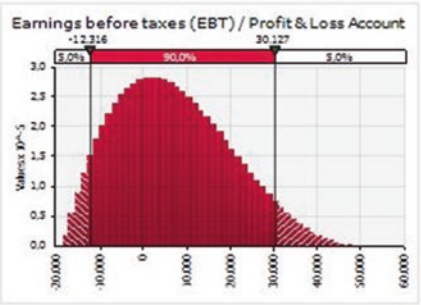
Change in Output Statistic for Cash from Operations / t+1			
Rank	Name	Lower	Upper
1	Interest rate loans / t+1	157.655	163.769
2	Tangible Assets / t+1	158.371	162.988
3	Long-term Loans & Bonds / t+1	160.317	160.403

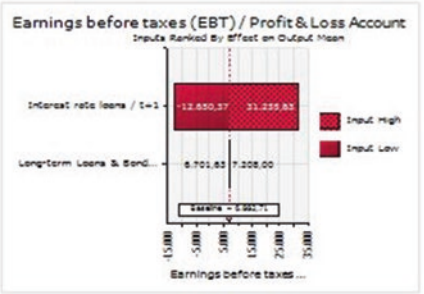
Fig. 4 Risk output EBT first case

interest rates, followed by tangible assets and finally the volume of loans. In addition, if we keep the loans and property, plant and equipment fixed and let only the interest rate change then the Cash from Operations t + 1 ranges from 157,655 and 163,768 euros (Fig. 6).

Finally, we observe that the Earnings before taxes (EBT) between −14,105 and 37,625 euros in a period of 95% confidence. The variable that affects the most is

RISK Output Report for Earnings before taxes (EBT) / Profit & Loss Account C71

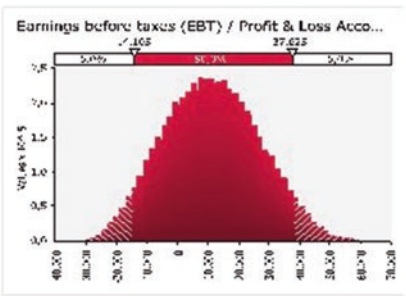


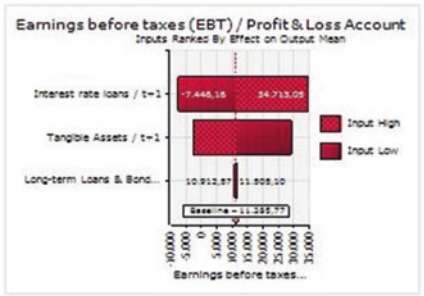


Change in Output Statistic for Earnings before taxes (EBT) / Profit & Loss Account			
Rank	Name	Lower	Upper
1	Interest rate loans / t+1	-12.650	31.236
2	Long-term Loans & Bonds / t+1	6.702	7.208

Fig. 5 Risk output cash from operations second case

RISK Output Report for Earnings before taxes (EBT) / Profit & Loss Account C71





Change in Output Statistic for Earnings before taxes (EBT) / Profit & Loss Account			
Rank	Name	Lower	Upper
1	Interest rate loans / t+1	-7.446	34.715
2	Tangible Assets / t+1	-2.512	29.330
3	Long-term Loans & Bonds / t+1	10.913	11.505

Fig. 6 Risk output EBT second case

again the interest rates and not so much the volume of loans and property, plant and equipment. Moreover, if we keep the loans and property, plant and equipment fixed and let only the interest rate change then the Earnings before taxes (EBT) ranges from −7.446 to 34.715 euros.

8 Massive Solutions for NPL: Securitization

Since in real economy the transactions do not take place under "pareto optimal" situations, where one of the two counterparties win and the other loses (win-lose situation), we also have circumstances where both counterparties win (win-win situation) resulting in that the economy in total move within the "pareto optimum" borders. This asymmetry is due to organizational structures of reducing costs (cost-advantage) that one of the two counterparties achieves in managing financial assets. Another factor that creates asymmetries is also the financing cost, especially when one of the two counterparts is active in a country that faces financial crisis. According to the above, it is possible that a financial asset which has no value for someone and, according to IFRS has no cash flow generated in the future, may actually have value for someone else. If a sale transaction takes place, it will take place on a price equal to the present value of the cash flow that the buyer can generate from the asset, using as discount rate the Weighted Average Cost of Capital (WACC). Taking the above technicalities into account, we will examine the following situation.

As (Liapis and Roumeliotis 2017; Liapis 2018), describe, through public tendering, the Bank is looking for an investor with appropriate expertise in NPEs management; a choice that will result in a win-win solution, pursuing mutual profit for the Bank and the investor, but also for the country's borrowers. Developed by the Bank and its Advisers, a financial transaction which is selling a big amount of its NPEs and transforming its claim from Loans to Debt Securities (Debt instruments—Senior Bond of increased collectability and junior subordinated bond of lower collectability) is issued by the new loan holder (SPE), following a securitization procedure (Tables 6 and 7).

Table 6 Legal entities involved in securitization

Legal entities involved	
Bank	NPE Portfolio Initial Owner and Bond holder of Bond A
Securitization SPE	Owner of the NPEs portfolio and Issuer of Bonds A and B
AMC Servicer	Servicer of the NPEs portfolio
Investor	Majority shareholder of AMC and Bond holder of Bond B
Cash Manager	An independent legal entity with a mandate to allocate the cash flows arising from NPEs Management from the Servicer, to all parties according to a predefined hierarchical order.
Trustee	Responsible for the correct implementation of all legal relations between all the above entities.

Table 7 Legal contracts involved in securitization

Legal contracts	
LPPA	Loan portfolio purchase agreement
NPA	Note purchase agreement
STA	Share transfer agreement
SPA	Sale + purchase agreement
PSLA	Primary servicing loan agreement
SFSA	Short form servicing agreement

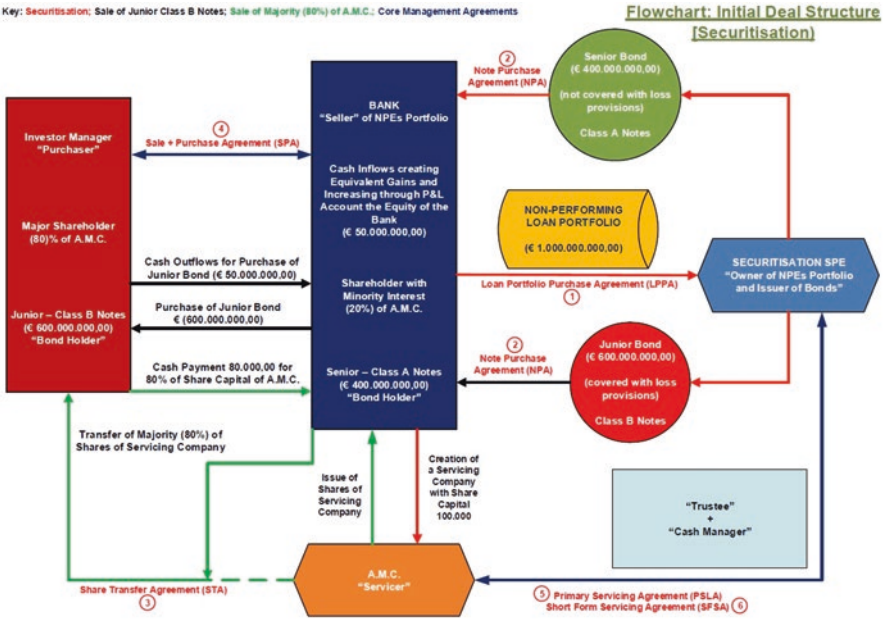


Fig. 7 Initial deal structure

The Legal Entities involved in our case study are described below:

All the legal contract involved in our case study are summarized below:

The whole process can be applied with a two-stage process. First, we describe the Initial Deal Structure (Securitization) and then the Final Deal Structure (Derecognition) (Fig. 7).

1. Initial formation of the portfolio and the specific terms of the securitization.

   The Bank forms the portfolio of specific NPEs, determines the specific terms and conditions especially the face value the maturity of the bonds and the seniority of payments (waterfall).
2. Public Tendering for NPE management.

   Through a public tendering the Bank is looking for an investor with appropriate expertise in NPEs management; a choice that will result in a win-win solution, pursuing mutual profit for the Bank and the investor. The potential investor with his bid will buy for a certain amount the exclusive right to manage

the portfolio of 1 billion euros taking a fixed management fee for the management and also Bond B (junior bond) to have an extra motivation to reach high collectability rates.

3. Nomination of Trustee and Cash Management services Firms

   The Bank in cooperation with the Investor chooses the Financial Intermediators which will control the legal relations as described by all signed legal agreements envisaged in Trust Deed as well as the implementation of the hierarchy order of payment (as described by the waterfall) envisaged in Cash Management Agreement.

4. Establishment of a Special Purpose Entity and an Asset Management Company

   The Bank establishes an SPE and a AMC to proceed with securitization procedures.

   The SPE should be incorporated under U.K. Legislation as it is more investor-friendly.

   In accordance with the provisions of Law 4354/2015 or any other current legislation, AMC must be licensed by the BoG, which considers the feet and proper set of criteria for the shareholder of the AMC, before giving its consent.

5. Loan Portfolio Purchase Agreement

   The Bank sales the NPEs portfolio of 1 billion euros at current value to the SPE through an Loan Portfolio Purchase Agreement.

6. Issuance of two Bonds

   The SPE Issues Two Bonds from the current NPEs portfolio.

   (a) Bond A (Senior Bond) with a nominal—face value of 400 million euros and a maturity period of 10 years, which is not covered with loan loss provisions and has a priority of payment from the cash flows arising from NPEs management income as well a quarterly interest payment of 3% on its outstanding amount and

   (b) Bond B (Junior Bond) with a nominal—face value of 600 million euros and a maturity period of 10 years, which is covered fully with loan loss provisions, is paid if there is a leftover amount, after all prior payments from cash flows arising from NPEs management income have been settled and doesn't receive any interest payment.

7. Note Purchase Agreement

   The Bank buys back from the SPE the two separate Bonds at current value, through a Note Purchase Agreement.

8. Sale + Purchase Agreement

   The Bank sells Bond B to the preferred investor.

9. Share Transfer Agreement

   The SPE, and NPEs Asset Management Company (AMC) shares are being transferred between the Bank and the investor in such a way to make sure that the bank never exceeds 20% of the shareholding.

10. Primary Servicing Agreement, Sort Form Servicing Agreement

    PSA and SFSA regulate the basic relations between the SPE, that is the owner of the NPEs Portfolio and the Issuer of Bond A and Bond B, and the AMC collections company, as the servicer (Fig. 8).

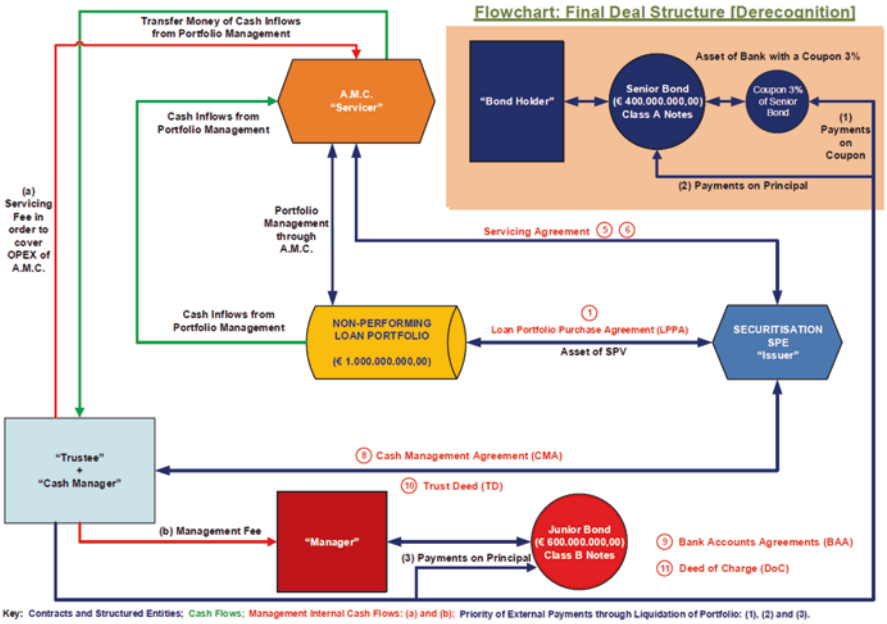


Fig. 8 Final deal structure

In operational stage, NPEs Asset Management Company (AMC) as the servicer, collects payments and forwards the cash flows to Cash Manager as described in the servicing agreement PSA and SFSA. The Cash Manager distributes the amount from collection cash flows according to a predetermined seniority order (waterfall of payments) as described in the Cash Management Agreement signed between Cash Manager and the Issuer (SPE). The waterfall of payments is described as follows:

1. A Servicing Fee is paid first to cover the Operating Expenses of the Servicer.
2. A Variable management fee is paid to investor's entity called The Manager.
3. The payment of interest coupon of 3% on outstanding Senior Bond amount comes third.
4. In fourth place, there is the payment of principal for Bond A.
5. The retention of amount in order to form a redemption reserve of 5% of senior bond as dictated by EU Regulations comes next.
6. Last comes the payment of principal for Bond B.

As we can see from the following Tables 8 and 9, the Bank has now been cut off from all the other parties and mainly from those directly and indirectly linked to the portfolio that the bank sold. It is clear from this point that the bank is independent from this portfolio and that de-recognition has been achieved both theoretically and practically.

Table 8 Derecognition process

Derecognition Process according to the Derecognition Tree Fig. 7		
Step 1	Consolidate all subsidiaries including any SPEs in accordance with IAS 27 in our Initial Deal Structure	
Step 2	The flowchart should be applied to the specific portfolio of NPEs we consider in this scenario, using the current values (book values of assets) and no the fair value of assets	
Step 3	The rights to the cash flows have not been expired and have been transferred to the SPE	No derecognition
Step 4	The rights of the cash flows have been transferred	No derecogntion
Step 5	The entity still bares risk from holding the senior bond, although we can have a different answer to this question if according to the SRT procedure a significant transfer of risk is determined (shadow phase)	No derecognition
Step 6	The entity has not control to the assets at the Final Deal Structure through the sale of Junior B bond and the transfer of AMC-servicer to the investor.	Derecognition

Table 9 NPEs portfolio characteristics

Portfolio characteristics	
Total amount of NPEs portfolio (TANPESP)	1.000.00
Senior bond A series (SBA) part A (SBAA)	380.00
Retention risk SBA part B cash coverage (SBAB)	20.00
Senior bond A series (SBA)	400.00
Junior bond B series (Junk) (JBB)	600.00
Purchase price of JBB	50.00

Following the above steps, the Bank can fully derecognize the 1 Billion NPEs portfolio, given that, as we analyze in derecognition, all risk and rewards, management and future rights have been transferred irreversibly to the investor, with the Bank recognizing only the Senior A Bond of 400 million as a new financial instrument with specific (interest payments) and variable (principal payments) cash flows. At regulatory level, a Significant Risk Transfer report must be fulfilled and accepted by the regulator (Central Bank) in order to adjust the level of Risk Weighted Asset and CTE1 accordingly.

In addition, Senior A Bond as a financial instrument can be used for liquidity purposes like REPOS or Collateral to Financial Markets.

By following the flowchart provided by the IFRS 9 and using the characteristics of the transaction that we examine, we conclude that the Bank at step 6 (or even from step 5), should derecognize the portfolio of NPEs.

In order to assess the recoverability efficiency of senior bonds under the above specific legal framework structure of securitization process, we have constructed a Business Plan model, taking the following assumptions into account:

The total amount of NPEs Portfolio to be securitized is 1 billion euros which consists of a Senior Bond A of 400 million face value, a 5% on Senior Bond A Retention Risk Cash Coverage (included in the amount of 400 million Senior Bond A), a Junior Bond B, which is fully covered with provision from the Bank, and a hypothetic price of JBB purchase by the investor of 50 million euros.

In Table 10, we assume that (a) the collaterals provided to the specific NPEs of €1 billion, have a Fair Value of €700 million, a figure that can be estimated by an independent financial consultant. (b) The rate of initial provision coverage is 60% as €600 million (Junior Bond B) has been fully covered. (c) Initial Collectability Rate is assumed at 40%. This practically means that at least the value of Senior Bond A will be collected, setting the minimum Collectability Rate. (d) The Rate of Collateral Coverage is set to 70% arising from the Fair Value of Collaterals €700million to the total value €1 billion of the NPEs portfolio, setting the upper limit or maximum Collectability Rate of 70%. This allows to assume an average Collectability Range of 55%.

In Table 11, Performance Rates, we describe the order of payments from collection inflows as well as the percentage of fees per year. The Constant Servicing Fee, has been agreed with the investor in order to cover the operational expenses of the AMC as the Servicer. The Variable Management Fee is also calculated upon agreement with the investor. For the purpose of this chapter, we assume a CSF of 5% on the yearly collected amounts, and a VMF of 2% on the outstanding amount of NPEs Portfolio. We also assume an interest rate R 3% as an interest coupon on the outstanding amount of Senior Bond A, a final collectability rate of 60% and a 60% write offs. Finally, we exhibit the Waterfall of Payments, as described below.

As we observe in Table 12, with all the above assumptions considered, the bank as a bondholder of Bond A, will receive an amount of €501.42 million with a net present value of €413.52 million, making an extra profit of €13.52 million in a 10-year period. On the other hand, for the same period the investor will obtain gross revenues of €91.12 million and net revenues of €40.12 million with a 19.06% Internal Rate of Return (IRR).

The aforementioned results are based on a business model with specific assumptions considered. At this point we will stress this model in order to draw conclusions even under uncertainty situations. This step is crucial since a potential investor wants to know all the possible outcomes that his investment may have in order to decide if he will undertake the investment. The variables that we are going to stress, are the Final Collectability Rate, the Management Fee per year and the OPEX Rate

Table 10 NPEs collectability rates

Collectability rates		
Fair value of collaterals (FVC)	*700.00*	
Rate of initial provision coverage	60.00%	
Initial collectability rate	40.00%	Min
	100.00%	
Rate of collateral coverage	70.00%	Max
Average collectability range	55.00%	

Table 11 Performance rates

Performance rates		
Variable management fee (VMF)	*Agreement*	
Constant servicing fee (CSF)	BP	Per year
Payback assumptions	Rank	
CFS	1	5%
VMF	2	2%
SBAA+SBAB+R	3	
JBB	4	
Performance/discount interest rate	3.00%	3.00%
Write offs	60%	Servicer
	40%	Deferred
Bank's write offs	100%	Provisions—Junior Note
Final collectability rate (FCR)	60.00%	Min < FCR < Max
Loss collectability rate (LCR)	40.00%	LCR = 1 – FCR

Table 12 Model Outputs

Output		
Bank	Amounts	Gap
Net revenues	501.42	101.42 €
NPV of revenues	413.52	13.52 €
Investor	Amounts	Rates
Gross revenues	90.12	
Net revenues	40.12	
NPV of revenues	30.73	
IRR		19.06%

per year. The range that we considered for these variables are summarized in Table 13.

In Fig. 9, there is a summary of the results of the stress test to the Investor's IRR with 10,000 Iterations and the three inputs incorporated (Final Collectability Rate, the Management Fee and the OPEX Rate). The investor's IRR moves between 5.25% and 18.16% with a 90% confidence interval. The greatest impact to the Investor's IRR stems from the Final Collectability Rate, then the Management Fee per year follows and then the OPEX Rate per year.

If we set the Management Fee and the OPEX Rate as constant, using only the FCR as changing variable, the Investor's IRR would move between 6.13% and 17.16%. Following the same procedure and having the Management Fee as the only variable changing, the Investor's IRR would move between 9.8% and 15.77%. Finally, having the OPEX Rate as the only variable changing, the Investor's IRR would move between 10.85% and 13.95%.

In Fig. 10, there is a summary of the results of the stress test to the Investor's NPV of Revenues with 10,000 Iterations and the three inputs incorporated (Final Collectability Rate, the Management Fee and the OPEX Rate). The investor's NPV of Revenues moves between –€24.13 and €36.37 with a 90% confidence interval.

Table 13 Model Inputs

Name	Cell	Graph	Min (%)	Mean (%)	Max (%)
Final collectability rate (FCR)/Rank	I17		54%	60%	66%
Managemet FEE/per year	J9		1%	1.5%	2%
OPEX rate/per year	J8		3%	5.5%	10%

The greatest impact to the Investor's NPV of Revenues stems from the Final Collectability Rate, then the Management Fee per year follows and then the OPEX Rate per year.

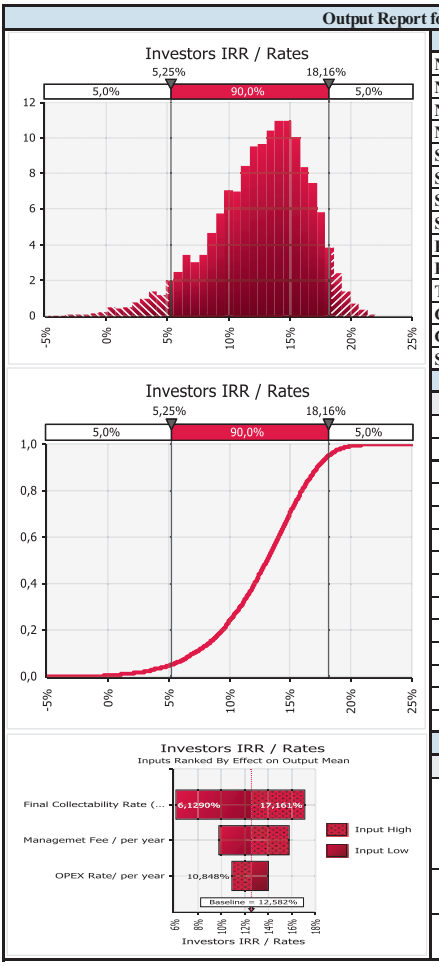
If we set the Management Fee and the OPEX Rate as constant, using only the FCR as changing variable, the Investor's NPV of Revenues would move between −€19.46 and €24.37. Following the same procedure and having the Management Fee as the only variable changing, the Investor's NPV of Revenues would move between −€2.58 and €15.67. Finally, having the OPEX Rate as the only variable changing, the Investor's NPV of Revenues would move between €1.63 and €15.03.

It is particularly interesting to observe the anomaly in the curve in the NPV of Revenues/GAP. This fall is due to the fact that at that point the retention ratio of 5% is paid. After the retention ration is filled, then the NPV of revenues is skyrocketing.

9 Conclusions

This section provides an overview of the findings of the chapter, following its current development at the time of writing.

With reference to the question "What are the macroeconomic and microeconomic factors that interact and how do they affect NPLs?" and "Once they have been identified, how can they contribute to tackling the problem of NPLs?", the conclusion reached is that, by identifying those macroeconomic and microeconomic factors that affect NPLs, institutions can adopt the appropriate measures to deal with them. More specifically, as it is expected, unemployment has a positive effect on the growth of NPLs, especially on retail portfolios, while an increase in the GDP has a negative effect. In addition, overdue debts are the ones that have a positive effect on NPLs, which means that the higher the government debt, the higher the NPL; this is also an expected result, since, as mentioned above, people who cannot meet their obligation towards the state are unlikely to meet their obligations towards the banks. By following the same approach, we observed that inflation negatively affects NPLs. Whenever high prices prevail for long periods of time, the value of NPLs diminishes and, therefore, arises a negative relationship, as inflation facilitates the payment of NPLs with overvalued money. Moreover, we looked at how the



Simulation Summary Information	
Number of Simulations	1
Number of Iterations	10000
Number of Inputs	3
Number of Outputs	2
Sampling Type	Latin Hypercube
Simulation Start Time	22/3/2018 18:11
Simulation Stop Time	22/3/2018 18:14
Simulation Duration	00:02:57
Random # Generator	Mersenne Twister
Random Seed	1991161880
Total Errors	1275
Collect Distribution Samples	All
Convergence Testing	Disabled
Smart Sensitivity Analysis	Enabled

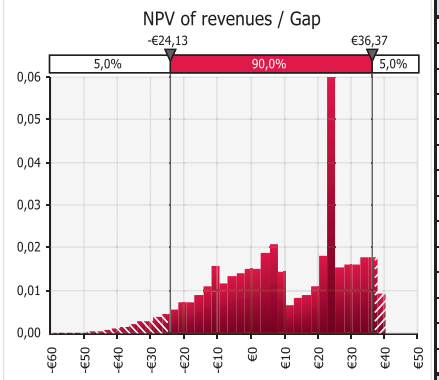
Summary Statistics for Investors IRR / Rates			
Statistics		Percentile	
Minimum	-4,78%	**1,0%**	1,33%
Maximum	22,05%	**2,5%**	3,45%
Mean	12,58%	**5,0%**	5,25%
Std Dev	3,98%	**10,0%**	7,02%
Variance	0,001581051	**20,0%**	9,47%
Skewness	-0,675482848	**25,0%**	10,16%
Kurtosis	3,4207821	**50,0%**	13,11%
Median	13,11%	**75,0%**	15,43%
Mode	15,01%	**80,0%**	15,97%
Left X	5,25%	**90,0%**	17,24%
Left P	5%	**95,0%**	18,16%
Right X	18,16%	**97,5%**	18,88%
Right P	95%	**99,0%**	19,77%
#Errors	1275		

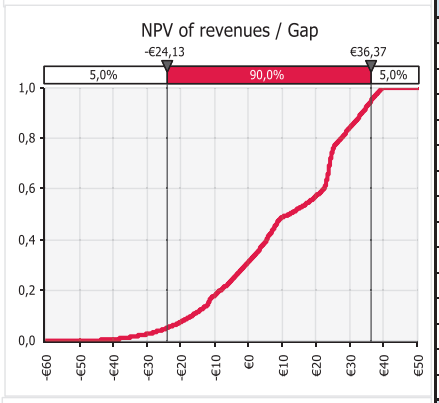
Change in Output Statistic for Investors IRR / Rates			
Rank	Name	Lower	Upper
1	Final Collectability Rate (FCR) / RANK	6,13%	17,16%
2	Managemet Fee / per year	9,80%	15,77%
3	OPEX Rate/ per year	10,85%	13,95%

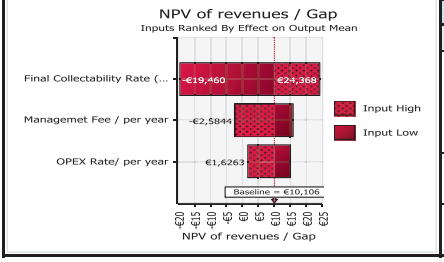
Fig. 9 Output for Investors' IRR

portfolios of non-performing loans are affected as a whole, as well as how they are affected by the index-rate describing the type of portfolio of public and corporate debt to the public sector and to the GDP respectively. We notice that the higher this index is, the bigger the number of NPLs, which is reasonable. In addition, we notice that the business portfolio is the one with the largest Rsquared. In order to observe the effect of the liquidity crisis on the financing of loans from deposits, we reversed the index "loans to deposits" with the pseudo-variable of the liquidity crisis, taking the value 1 for the years 2010–2012 and 2015–2016. From the data obtained, it is safe to conclude that the effect of the liquidity crisis has been significant. In a difficult-in terms of liquidity- environment, with the loan-to-deposit ratio set to 1.31 on a fixed basis, the effect of the emergency circumstances of the years described in the variable, has pushed the index to 20%. Through the cross fixed effect analysis, we

Output Report for NPV of revenues







Simulation Summary Information	
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Simulation Duration	00:02:57
Random # Generator	Mersenne Twister
Random Seed	1991161880
Total Errors	1275
Collect Distribution Samples	All
Convergence Testing	Disabled
Smart Sensitivity Analysis	Enabled

Summary Statistics for NPV of revenues / Gap			
Statistics		Percentile	
Minimum	-59,02 €	1,0%	-36,83 €
Maximum	40,37 €	2,5%	-30,70 €
Mean	10,11 €	5,0%	-24,13 €
Std Dev	19,30 €	10,0%	-16,50 €
Variance	372,3050084	20,0%	-8,18 €
Skewness	-0,495858194	25,0%	-4,13 €
Kurtosis	2,395612845	50,0%	12,05 €
Median	12,05 €	75,0%	24,83 €
Mode	23,86 €	80,0%	27,30 €
Left X	-24,13 €	90,0%	33,65 €
Left P	5%	95,0%	36,37 €
Right X	36,37 €	97,5%	37,75 €
Right P	95%	99,0%	38,74 €
#Errors	0		

Change in Output Statistic for NPV of revenues / Gap			
Rank	Name	Lower	Upper
1	Final Collectability Rate (FCR) / RANK	-19,46 €	24,37 €
2	Managemet Fee / per year	-2,58 €	15,67 €
3	OPEX Rate/ per year	1,63 €	15,03 €

Fig. 10 Output for Investors NPV of Revenues

observed that the bank that best dealt with the liquidity crisis was Alpha Bank, while the one that suffered the most was the National Bank. The chapter proceeded to the above assessments in order to present the problem of NPLs and the imperative necessity of finding solutions. As it turned out, many factors influenced the formation of the great number of NPLs: factors that were not only macroeconomic and conjunctural but also internal indicators existing within the credit system, which was unable to address this problem due to problems of different nature that it was faced with.

Regarding the question "How can decisions be made to help choose among a vast array of ways to settle NPLs?", the conclusion of the chapter is that only through the development of consistent models, based on Accounting Science, on Business Administration, on Finance and Banking, can one make safe decisions on how to deal with the problem of NPLs.

Concerning the question "What is the hierarchy of the factors involved in the financial engineering of loans that affect the possibility of servicing loans?", the answer would be the factors in the following order: the amount of the loan, especially in the case of trading after a haircut, the interest rate, the time of the loan, the grace period for making installment payments, the possibility of paying a portion of the loan as a Ballon amount at the end of the period, the technical type of the loan (bankruptcy, interest-bearing, single) and the designated payments to be made as installments per year.

Then, there is the question of whether it is possible to create a single model in which, by entering the historical data of any company, the main variables that affect its profitability will be prioritized; also, how loan charges are prioritized, as well as the cost of servicing the loans during the decision-making process of companies. As far as these questions are concerned, the chapter has reached the following conclusions.

With reference to the question of whether it is possible to create appropriate models, the contribution of the chapter lies in the creation of a model that connects a cash-flow statement, a balance sheet, a model of additional necessary funds, a statement of profit and loss and some indicators of both interpretive nature—assumptions, independent variables—and endogenous nature—results, dependent variables. Therefore, the chapter concludes that it is possible to create such models.

In the model, the development of the necessary interdependencies between the variables took place; the functions are categorized as (1) interpretive, (2) identities and (3) time-related.

Most short-term and medium-term arrangements of a company can be analyzed using the above-mentioned tool, developed by this chapter. For this reason, we have chosen as point of reference the charge of a business on interest rates and amortizations for 3 years. The development of the model and the above-mentioned technique are original and constitute good practice; therefore, they should be established as a way of studying financial burden and business loan management.

The conclusion of the chapter on dealing with problems that arise from NPLs is that it is the cost of debt that affects a business more, rather than the amount of debt; depreciation policies are mandatory to be implemented in this case. The above conclusion was drawn through historical frequency distribution for debt, debt costs and fixed tangible assets to control the impact of debt and deleveraging through Monte Carlo simulation for business efficiency.

One notable finding is that, compared to other variables that affect NPLs, such as cost of sales, the problem of the costs of loans is a secondary problem that arises in times of crisis, during which businesses cannot implement their administrative and marketing policies. Thus, according to the methodology applied, it turns out that companies that are in the process of sustainability but are faced with funding problems, should adopt policies aimed at reducing the cost of borrowing and the procedures

towards deleveraging. On the other hand, Haircut policies are of secondary importance to companies that are in a position of making even average operating profits.

In relation to the question of whether NPLs can be addressed through a process of securitization and with the adoption of a mass solution to the problem by banks and not only through retail loan arrangements, the conclusions are the following.

Primarily, in order to accurately carry out a derecognition of an NPL portfolio, securitization should not be performed at fair value but at current accounting value, so that the bonds issued will be able to be classified (a) as senior bonds, whose value is almost equal to the fair value, and (b) as junior or junk bonds which reflect the impairment of assets and, therefore, the necessary provisions kept by the bank. An investor may not be able to buy senior bonds but may possess the know-how to manage NPLs as well as the necessary funds in order to buy junior or junk bonds. The chapter did not deal with the simple case in which an investor buys a portfolio of NPLs directly or by means of securitization. The problem that was examined, was transformed into a problem of risk deriving from the sharing of the NPL portfolio, between the bank and the investor. In this case, the conclusion reached is that, from an accounting-theoretical point of view, when applying securitization, the value of the senior bonds does not depend on any of these NPLs per se; it depends on the cash flow of their collectability within the necessary vehicle company (SPV) for the implementation of the securitization.

After examining two different complex types of securitization, the conclusion of the chapter was that, in order for a securitization to be successful, for the NPLs from a bank's portfolio to be recognized and for senior bonds of securitization to be collected through cash flows, the bank's portfolio must present a satisfactory IRR for the investor. The samples that were produced and are a technical contribution of this chapter, were put through sensitivity analysis—to determine the main factors that affect the hassle-free handling of senior bonds—as well as through a historical specialization of the repayment rate of NPLs, through the Monte Carlo simulation.

In general, the collectability of the market bonds, produced during the securitization, through which the returns for the bank and for the investor are secured, must be checked. The bank's returns will, of course, be lower, as it is the bank's direct priority to rid itself of the burden of NPLs. Following the appropriate negotiations between the investor and the bank, the yields provided on the returns facilitate the finalization of the transaction.

The main conclusion to be drawn is that the bank must ensure that derecognition of NPL portfolios will take place at no additional cost for the bank in the future; at the same time, the risk of the derecognition, burdening the investor, must be counterbalanced by a significant return on the investment. The Monte Carlo simulation analysis focuses on the management of securitized portfolios for the achievement of the above-mentioned goals. It should be noted that the Collectability Rate of the portfolio, on which securitization is applied, provides the necessary Cash Flows that the securitization bonds serve. In this type of portfolio, there is no such thing as loan collectability through service; rather than that, final arrangements are created by Cash Flow from liquidation of funds or other legal actions.

On the domain of wholesale regulations, models, design and estimates are major contributors of this chapter.

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Measuring the Emotional and Cognitive Consumers' Responses During Interaction with Marketing Stimuli

Alessia Vozzi, Vincenzo Ronca, Patrizia Cherubino, Arianna Trettel, and Fabio Babiloni

Abstract This chapter presents some considerations about the employment of neuroscientific tool in real environments for measuring the brain and emotional activity during the consumers' decision-making activities in different contexts of consumption and choice.

Keywords Neuromarketing · EEG · Emotion · Heart-rate · Eye-tracking · Decision-making

Alessia Vozzi and Vincenzo Ronca authors contributed equally to this work.

A. Vozzi (✉) · V. Ronca (✉)
Department of Anatomical, Histological, Forensic and Orthopedic Sciences, Sapienza University of Rome, Rome, Italy

BrainSigns srl, Rome, Italy
e-mail: alessia.vozzi@uniroma1.it; vincenzo.ronca@uniroma1.it

P. Cherubino
BrainSigns srl, Rome, Italy

Department of Molecular Medicine, Sapienza University of Rome, Rome, Italy
e-mail: patrizia.cherubino@uniroma1.it

A. Trettel
BrainSigns srl, Rome, Italy
e-mail: arianna.trettel@brainsigns.com

F. Babiloni
BrainSigns srl, Rome, Italy

Department of Molecular Medicine, Sapienza University of Rome, Rome, Italy

Department of Computer Science, Hangzhou Dianzi University, Hangzhou, China
e-mail: fabio.babiloni@uniroma1.it

K. Nermend et al. (eds.), *Decision-Making in Management*, Contributions to Management Science, https://doi.org/10.1007/978-3-030-67020-7_8

1 Introduction

Years of research have shown that many of our mental processes occur on an unconscious level, including the decisions we make as consumers. It is known by neuroscience how the brain systems connected to emotion in humans play a fundamental and often unconscious role (that is, subtracted from conscious cognitive control) during the decisions we generate every day. Very often the emotions perceived during the sensory stimulations to which we are subjected in everyday life do not manifest themselves to our conscious control, while instead they guide our behavior perceived as "spontaneous" or natural. In fact, often we are unable to rationally justify our purchasing behavior, which often differs greatly from our initial intent in favor of a purchase "spur of the moment" based on purely instinctive reasons. This explains why often we fail in carefully predict our future choices. What we think we want doesn't always correspond to what we really do.

The reason for these decision-making behaviors apparently out of conscious rational control when choosing goods or services is based on the fact that the emotional systems within the human brain can easily access the behavioral decision centers without being subjected to the filter of cognitive brain activity.

Our purchasing decisions therefore not only respond to rational dynamics but also to emotional and instinctive impulses, the result of the unconscious activity of the brain, that is, generated by brain systems that activate before our rationality and awareness. Such impulses could play a crucial role in the development of behavioral tools in management.

However, this knowledge of consumer behavior is quite recent and different from what was believed many years ago. The behavior of individuals has always been represented by neoclassical economists as the result of a linear decision-making process that tends to maximize the usefulness of the subject by evaluating the costs and benefits associated with each of the possible alternatives of choice. Some authors, however, even then, wondered about the validity of the neoclassical representation by stating that: "human behavior in general, and presumably, therefore, also towards the market, is not under the constant and detailed influence of careful and accurate hedonistic calculations, but it is the product of an unstable and irrational complex of reflexes, actions, impulses, instincts, uses, customs, fashions and hysteria" (Viner 1925).

After the Second World War, the theory of limited rationality (Simon 1955), the theory of the prospect of Kahneman and Tversky in 1979, imposed themselves as valid alternatives to the formal theory of choice in conditions of uncertainty. A few years later, in 2002 Daniel Kahneman, founder with Tversky of behavioral economics and in 2017 with R. Thaler who followed in his footsteps, the limits of classical economic theory became more evident, arguing that, as human, we are never one hundred percent rational, but subject to errors and indecisions. In his research work, Thaler analyzed the relationship between our tendency to make realistic assumptions and economic choices.

By analyzing the consequences of "limited rationality," "social preferences" and "lack of self-control," Thaler has shown how specific characteristics of human psychology condition decisions and consequently the results for the markets in the economic sphere. Therefore, consumers do not always make rational and well-calculated decisions, but sometimes their behavior is guided by unconscious processes.

This is the reason why we often find our brain represented on various books and articles as an iceberg where, the submerged part, is the one that guides our behaviors and our actions (Fig. 1), unlike the part in surface which is the most "aware."

Fig. 1 The image shows how many of our mental thoughts occur below the threshold of awareness

Emotion is therefore a very important factor in the decision to purchase a good or service, just as it plays a fundamental role in our perception of the image of a company through the vision of its brand or product, service or communication. As Antonio Damasio said in Descartes' Error (Damasio 1995), "We are not thinking machines that get excited, but emotional machines that think." Measuring the emotion aroused by a product or image can however be a difficult exercise, especially if measured with traditional market research tools, which often measure the "declared," what people verbally report following a series of questions that the interviewer asks them (via interview, focus group, administration of questionnaires etc.).

In these cases, there may be a problem of "self-perception" of the emotion itself: we have already said how a perceived emotion may simply not appeal to our conscious attention while inducing precise behavior. When this happens there are verbal statements similar to "I can't explain why I made this choice."

There may also be a problem of "descriptive ability" of the emotion itself experienced in front of a product or service, by the interviewee. Often, we hear people say: "I can't express what I feel, what this image/product/brand gives me." It may happen, in fact, to perceive an unpleasant sensation in the body, but not to be able to identify if it is anger, fear or sadness. Based on the explanation we give ourselves, we will act accordingly: labeling an emotion of anger as anxiety, for example, will entail our search for protection or an attempt to avoid stressful contexts, moving away from the "solution" of the problem.

Finally, there may be a problem of "willingness to share" by the interviewee of his emotions with the interviewer. There may be some resistance in wanting to share the emotion felt because it is thought to make us appear weak, or for reasons of social desirability we do not express what we really feel, for fear of judgments etc.

The purpose of this document is therefore to share some scientific methodologies for measuring emotion and not only, through the objective recording of some physiological and brain variables of consumers in front of marketing stimuli (e.g., an advertising video, the company logo, the display of shelf products in a store, a website). The technological and methodological novelty of this contribution is that these emotions (and the related brain processes) can be measured during the use of marketing stimuli in increasingly "ecological" conditions, i.e., close to what happens in everyday life. This is possible thanks to methodological and technological advancements of the devices for measuring the human brain and emotional activity, that today are increasingly wearable (Borghini et al. 2019; Di Flumeri et al. 2019) and can safely be used outside the scientific laboratories of universities or research centers. The concrete advantage of the quantitative measurement of emotional and cognitive activity during the use of marketing stimuli in a specific target audience is given by the possibility, after the analysis of these activities, to better modulate the communication or the realization of new products or services, promptly recognizing their strengths and weaknesses, improving the ability of end users to use them.

The relevance of this contribution for companies lies, therefore, in the information that the quantitative and objective measure of emotional and cognitive states in people subject to consumption stimuli:

1. can be obtained outside of scientific and university laboratories;
2. allows to work concretely for the improvement of the advertising message and for the improvement of the corporate communication;
3. is possible in the various stages of communication, product, website (both before launch, pre-test, and subsequently, post-test)
4. provides information not directly obtainable through the respondents' explicit verbalization processes.

The measurement of emotion and brain processes associated with the instinctive and unmediated perception of advertising communication can therefore provide additional and complementary evidence to that obtainable through other typical methodologies of traditional research. In addition, all this can also be applied to measure the perception of specific messages by particular professional categories, such as managers or personnel managers, employees, sales force and much more.

2 State of the Art

The question of how we generate, or should generate, decisions and judgments has occupied philosophers for many 100 of years and has kept some disciplines alive including philosophy and some branches of psychology. A recent approach, known as neuroeconomics, integrated some scientific ideas and discoveries from the fields of psychology, neuroscience and economics in an attempt to accurately specify what can be the choice and decision models in humans. The rationale for the integration of these different disciplines derives from the consideration that human's behavior in the financial field often seems irrational, as evidenced by the human events that are observed at the green tables of casinos, in betting shops, or even in the various exchanges equity. The discipline of neuroeconomics, described in the following pages, is defined as "the application of neuroscientific methods for the analysis and knowledge of human behavior of interest to the economy" (Babiloni et al. 2005). The remodeling of the research in the field of economics is not a new fact, since the boundaries of economic studies are continually remodeled by the advances in mathematics or statistical sciences. In this case, however, the advancement in the understanding of human behavior obtained with the methods of analyzing brain activity poses new problems and creates the confluence of distinct disciplines in a new area of scientific research, such as the aforementioned "neuroeconomics."

I know that half the money I spend on advertising is wasted, but I don't know what that half is," said John Wanamaker jokingly, who created the first US department store in 1876. Since then, the men of marketing and the politicians themselves have thought a lot about ways and means to better sell their products or ideas. The focus groups are widely used among advertisers and marketing experts, and brain imaging techniques applied to human decision-making mechanisms could be used to corroborate the results obtained with traditional techniques. The skeptics in the fields of neuroscience and marketing substantially express the thesis that economic

models and neuroscientific brain imaging techniques are on levels of behavior analysis so far away that they can hardly offer mutual help in understanding the problems that characterize social and economic human behavior. Although many of these experts doubt that brain imaging techniques can be used sensibly for this purpose, the so-called neuromarketing discipline has aroused much interest, and equally suspicious, through a series of articles published in important overseas newspapers, such as Forbes, The New York Times, and The Financial Times. Also, in Italy many newspapers with national circulation have given space to news (often confused and alarming) relating to the possible application of brain imaging technologies to evaluate the effectiveness of commercial communications.

It is understandable that the idea of assessing the neurological correlates of consumer behavior using brain imaging techniques can cause considerable excitement in marketing environments. However, it should be noted that the definition of neuromarketing as the application of neuroimaging techniques for the analysis of consumer behavior after exposure to advertising messages is very reductive. More correctly, however, neuromarketing can be defined as "The field of study that applies the methods of neuroscience to analyze and understand human behavior in relation to markets and market exchanges" (Lee et al. 2007). The contribution of neuroscience methods for the knowledge of human behavior in marketing becomes relevant. In fact, the fundamental problem in this field of study is the possibility to overcome the dependence of the measures of human behavior from the subject of study itself. These measures depend on the good faith and the accuracy with which the experimental subject reports his feelings to the experimenter. The use of brain imaging techniques can separate the subject's "cognitive" experience (and then expressed verbally during the interview) from the activation of the brain areas related to different mental states of which the subject himself may not have conscious awareness. Indeed, scientists have shown that the activation of specific brain areas corresponds to each perception, thought, action. These are also activated when we observe/codify communication, in building brand identity, in shaping our consumption decisions. Neuromarketing employs research methods based on the analysis of physiological signals that aim at solving marketing problems and not identifying the consumer purchase button, as it is lightly said in some contexts. With the help of advanced neurology techniques, applied in the field of consumer neuroscience, a greater vision in the consumer black box is now possible to better understand/explain what happens inside it (Fugate 2007). There is therefore a series of experimental evidences that seem to suggest that the use of brain imaging techniques can support the classic tests now widely used in marketing sciences.

3 The Neurosciences Supporting the Economic Theory of the Choices

Nowadays, neurosciences have started to provide the first direct tools for measuring people's thoughts and feelings. By means of a series of increasingly sophisticated and less and less "invasive" measuring instruments, we are now able to "observe"

the signs of brain activity in experimental subjects while carrying out both cognitive and motor tasks, as well as during the imagination of particular motor or cognitive acts. The possibility of "following" brain activity during the execution of cognitive processes in humans therefore represents a challenge to our understanding of the relationship between mind and action and simultaneously it leads to a new theoretical approach in various fields of social sciences, putting in crisis the previous ones. Without denying that reasoning is always a fundamental phase for human decision-making processes, research in the field of neuroscience highlights two very relevant facts for the purpose of making a choice. First, most of the human brain is used to support "automatic" processes, which are faster than any conscious reasoning and which also occur with less awareness and effort. Secondly, our behavior is under the dominant and unrecognizable influence of emotion, which can be located in particular regions of the brain and whose basic structural systems unite humans with many other animals.

In humans, behavior is the result of the interaction between controlled and automatic systems on the one hand, and between cognitive and emotional systems on the other. Furthermore, many behaviors that have clearly been established to be due to automatic or affective systems are interpreted by humans as the product of reason. The deliberative system, responsible for justifying the behavior, is unable to exert its influence over other systems, and it amplifies the importance of the processes that it is able to understand when it tries to justify the behavior of the body.

The objective of this chapter is to highlight some neuroscience discoveries that are thought to be relevant to the problem of how the individual generates behaviors aimed at maximizing, consolidating or acquiring the advantages that are obtained by interacting with goods or other subjects in the outside world. In particular, attention will be concentrated on the aspects of the study of human behavior in tasks where it is possible to highlight its economic interest. The individual's choices that can contrast with the usual rational choice models based on optimizing the relationship between costs and benefits for our actions will be emphasized.

Table 1 shows the distinction between controlled and automatic brain processes (Schneider and Shiffrin 1977) and that between reason and emotion. As described by the two rows of Table 1, the controlled processes tend to be serial (i.e., they use sequential logic or step by step), they are deliberately evoked by the subject at the moment of surprise or change (Hastie 1984), they are often associated with subjective feelings of effort and typically present consciously. Since the controlled processes are conscious, people often have good introspective access to them. Consequently, if people are asked how they would solve a math problem or choose a new machine, they would honestly provide a detailed account of their choice process. Standard methods of economic analysis, such as the decision tree, in the way they are currently used, adapt well to the controlled processes. Automatic and controlled processes can be clearly distinguished by referring to the place where they originate within the brain (Lieberman et al. 2002). The regions that support automatic cognitive activity are concentrated in the posterior (occipital), upper (parietal) and lateral (temporal) part of the brain. The amygdala, located under the bark, is responsible for many automatic affective responses, especially those that

Table 1 The table below shows some characteristics of the decision-making processes implemented in the human brain, from the different systems that coexist in this

	Cognitive	Emotional
Controlled Choice Processes: • Serial • They require attention • They can be summoned at will • Allow introspective access	I	II
Automatic Choice Processes • Parallel • Without attention request • Outside of conscious control	III	IV

relate to fear and anger. For the modulation of these responses, the amygdala collaborates with other subcortical structures, such as the hypothalamus and hippocampus.

Various neuroscientific research has shown that some of the automatic choice processes originate mainly in the frontal (orbital and prefrontal) regions of the brain (Damasio 1998). In particular, the prefrontal cortex is often called the brain executive region because it receives inputs from most other cortical regions, it integrates them to form short and long term goals for the subject and it plans actions that take these goals into account. The prefrontal area is the region that has grown the most in the course of human development and which consequently distinguishes us more significantly from the primates closest to us (Manuck et al. 2003).

Automatic processes, whether cognitive or emotional, are the normal way the brain works. These processes are always active, even when we dream, and they make up most of the brain's electrochemical activity.

Controlled processes occur only at particular times, when automatic processes are interrupted, which happens when a person has to face an unexpected event, make a decision or deal with any type of problem.

In addition to responding to painful and affectively significant stimuli, different components of the anterior cingulate respond to cognitive and perceptual tasks that evoke greater controlled processing (Derbyshire et al. 1998; Bush et al. 2000). In the Stroop task, for example, individuals are required to indicate the color in which a word is written (for example, for the word "red" written in blue, the correct answer is "blue"). This task is difficult because people automatically read the word and therefore, they have a domineering linguistic response that they find almost impossible to ignore. Controlled processes identify this overpowering response as inaccurate, they inhibit it and generate the correct response. This process takes longer in which color and speech are inconsistent, and in fact, there is more activation of the anterior cingulate cortex on trials with longer reaction times (MacDonald et al. 2000).

The second distinction, represented by columns 2 and 3 of Table 1, is between emotional and cognitive processes. A distinction of this type is dominant in contemporary psychology and in neuroscience and it has a historical response up to the

times of the ancient Greeks and before (Plato described people as if they were driving a cart drawn by two horses, the reason and the emotions that often take opposite directions). Zajonc (Gilbert et al. 1998) defines cognitive processes as those that answer the true/false question and emotional processes as those that motivate acceptance/rejection behavior. Emotional processes include emotions such as anger, sadness and shame, as well as "biological affections" (Buck 1999), panic, hunger and sexual appetite.

Another insight into automatic and controlled processes is offered by Daniel Kahneman who, as mentioned earlier, won the Nobel Prize in 2002 for integrating the progress of psychological research into economic science. He analyzed the complexity of people's reasoning when making economic decisions and showed that when people choose, they don't always do it objectively.

In his book, Thinking, Fast and Slow, he described how different thinking systems can influence judgment when people make decisions. The distinction between "fast" and "slow" thinking has been explored by many psychologists over the past 25 years. Kahneman did not invent the System 1-System 2 model of brain processes, but his work in recent decades has made him popular as one of the most useful general frameworks for understanding how the human brain works and, in particular, how the unconscious parts and mind conscious they work together. System 1 and System 2 are neutral terms that describe two distinct sensory and decision-making systems in the brain. System 1 is fast, automatic and beyond our volitional control; System 2 is slow, voluntary and under our control (Fig. 2). This model is the key to understanding why traditional research such as interviews, focus groups and surveys are at risk of distortions and why neuromarketing has emerged as an alternative and in support of them. Traditional marketing research is based on a brain vision of System 2, starting from the assumption that consumers always have access to their mental states and that they can accurately describe what they want and why they choose products and/or services. Instead, neuromarketing emerged because, through neuroscientific tools, scientists can offer new research methods that can also measure System 1 processes and provide new insights to understand how and why consumers respond to marketing stimuli and interact in the market (Kahneman and Egan 2011).

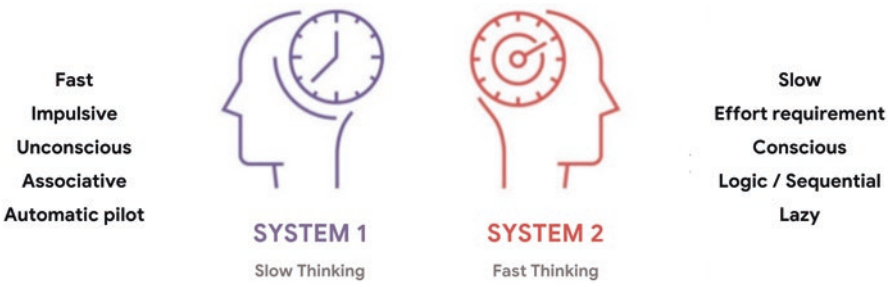

Fig. 2 Representation of System 1 and System 2 functioning, proposed by Daniel Kahneman

4 Orbitofrontal Cortex and Emotions

For many years, the study of emotions has not been addressed by science as emotion is a variable quite difficult to measure, as opposed to the attention or cognitive effort of the subjects during the performance of any experimental task. The emotion, given its individual perceptual characteristic, is difficult to evaluate and compare between different subjects. But that emotion played a fundamental role for the perceptual and decision-making characteristics of human beings had already been suggested by Charles Darwin (Darwin 1872) who claimed that emotions allowed an organism to better adapt to the salient characteristics of the stimuli proposed by environment. In the course of scientific research on emotion, in recent years a very useful work strategy has been dividing the study of the emotion into two different components: a component concerning a real emotional state, which can be measured through a series physiological parameters induced by the autonomic nervous system, such as changes in blood pressure, neurohormonal responses measurable through the amount of adrenaline circulating in the blood, and a second component concerning the feelings that these emotions generate in the nervous system central (Kringelbach 2004).

This emotional state can be measured in animals through the use of the experimental conditioning technique and, in this context, emotions are typically considered as the states that can be generated by the rewards or punishments provided by the researcher to the subject within his experimental condition. The representation of emotional stimuli in the cerebral cortex occurs on the basis of the type of reinforcement that is offered to the experimental subject following his behavior. The result of this processing influences the behavior of the entire organism and the consequent autonomic responses generated within the subject itself are subsequently presented to our awareness.

Emotional processing has been shown to be mediated by a set of brain structures, some of which are located at the cortical level. Some of these, in particular the orbitofrontal cortex, the amygdala and the cingulate cortex play an important role in the human brain in this processing. Other important brain structures that interact with the path of emotions in our brain are the hypothalamus, the nucleus accumbens together with the periaqueductal gray area. These brain regions act both as input systems and as output systems for the multimodal association regions of the brain, such as the orbitofrontal cortex itself, which is also actively involved in the representation and storage of events external to the subject that cause positive reinforcements for the same. In fact, from an anatomical point of view the orbitofrontal cortex has strong anatomical-functional connections with the rest of the brain; in fact, it receives input from the five classic sensory modalities such as gustatory, olfactory, somatosensory, auditory and visual. The same cortex also receives sensitive information from the neuronal networks located in the viscera, and the richness of these inputs makes it one of the areas of the brain among the richest in sensory inputs.

Only in the last few years there have been different studies, using the brain neuroimaging techniques described briefly previously, which have allowed us to know more closely the activity of the orbitofrontal cortex. These studies indicate that this cortex is a nerve center of convergence of all sensory information, which generate a modulation of autonomic reactions (those mediated by the autonomic nervous system), an involvement in learning and in generating decisions by the experimental subject (Ullsperger and von Cramon 2004). As mentioned earlier, the orbitofrontal cortex is part of several cortical neuronal networks that include regions of the prefrontal cortex (Brodmann areas 9, 46), amygdala, hypothalamus, and dopaminergic brain systems. This wealth of anatomical inputs and connections has led us to suppose that this cortex is heavily involved in the processing of emotional stimuli. This cortical region has been seen by neuroimaging studies to be activated during the generation of positive reinforcement stimuli for the subject more abstract than food gain, such as money gain (Thut et al. 1997). Recently, some studies employing neuroimaging techniques, such as fMRI and PET, have found that in the case of food, both the value of the reward and the expected value of this are represented in the orbitofrontal cortex, as well as the subjective pleasure that derives from it. These scientific results can be a starting point for further explorations of the brain systems involved in the conscious experience of pleasure. In particular, the connections of the orbitofrontal cortex and the cortical and subcortical areas related to it can offer interesting food for thought regarding the pathologies related to emotional disorders such as depression, or even with regard to compulsive pushes towards food or economic expenditure.

5 Interaction between "Cognitive" Systems and "Emotional" Systems During Decision-Making Processes

In the previous sections we have observed how modern theories of neuroscience can describe a framework of functions and systems that attempt to "break down" some qualities of the thousands of small or large choices that are made daily by our brain. In particular, it has also been seen how different cortical areas can interact with each other in different ways depending on the context in which the subject operates.

The behavior derives from the continuous interaction between neural systems that characterize the activity within each of the four quadrants presented previously in Table 1. Three aspects of this interaction must be highlighted, namely those concerning the collaborative aspects, those competitive and those called decision-making. The collaboration between the different neuronal modules tries to maintain a balance between the automatic and/or affective decision-making processes with the serial and cognitive ones. If the cognitive serial system (quadrant I) tries to do it all by itself, it will fail. The competitive aspect between the neuronal modules reflects the fact that the different emotional and cognitive processes often lead the behavior in two conflicting directions and compete for the control of the behavior

itself. Decision-making refers to how we become aware of this collaboration or competition and how we become aware of our behavior.

It is useful to distinguish between emotional and cognitive processes and between automatic and controlled processes since most judgments and behaviors derive from the interaction between them. Collaboration and the correct balance between the activities of the four quadrants are essential to face a normal decision-making process. For example, since the characteristic processes of the first quadrant (serial and cognitive) are mentally very expensive, thinking too much even when automatic processes work well is certainly not efficient.

Emotionality is, and should be, influenced by reason. The way you feel when you are impatiently waiting for a friend who is late, for example, will depend crucially on whether you are thinking that he has had an accident or simply forgot about the appointment. Emotional states, such as fear, which are seen as physiological rather than psychological, also have a strong cognitive component. Much more interesting, and certainly less known, is the fact that emotionality provides an essential input to the decision-making process. Damasio (Damasio 1994) has shown that individuals with small cognitive deficits but large emotional deficits present serious difficulties in decision-making processes. The emotional component is so important that often focusing too much on reasoning can lead to the wrong choice. In a study published a few years ago, some students were asked to select posters being able to choose them from a specific group prepared by the experimenter; all the students who were asked to indicate the reason why they liked the posters before they chose one, in the end declared themselves less satisfied with the choice made (and less gratified by hanging the poster in their room) than the students who had not been asked to justify their choice.

Emotionality can distort a judgment. For example, emotions have a great effect on memory, as when those who are sad always tend to remember sad episodes, which in turn increase sadness. Emotions also influence the perception of risk - anger makes people less aware of the risks, just as sadness has the opposite effect. Emotions can also create cognitions; many people are very good at persuading themselves that what they want to happen is just what will happen.

Understanding the emotional and cognitive components of risk reactions is very important when they diverge or even compete for behavior control. Often people have “two minds” when they have to face a risk. When we have to take the floor from a podium, to take an important exam, our decision-making system uses different tactics to convince us to take risks, or to complete our task despite the risks, which our emotional system would prefer much more to avoid. Perhaps, however, the most dramatic distinction between visceral reactions and cognitive assessments occurs in the case of phobias, which many people suffer from. The drama that accompanies a phobia is the inability to face a risk despite knowing it perfectly, objectively we are disarmed in facing it. Furthermore, fear triggers a series of preprogrammed behaviors that do not always bring benefits. Thus, when fear becomes

too intense it can produce counterproductive responses, such as cold sweats and panic. The fact that people are willing to pay to deal with their fears, and take alcohol and drugs to overcome them, is further confirmation that people, or rather, their decision-making system is not at peace with their visceral reactions to of risk.

The difference between different risk assessment systems can also be observed in relation to probability judgments. Numerous psychological studies have observed systematic divergences between explicit probability judgments in different experimental situations and implicit judgments deriving from a choice. For example, in a study it was proved that people prefer to take a ball from a container inside which there are 10 winning and 90 loser balls rather than extracting a ball from a container inside which there are 1 winning ball and 9 losers. The subjects claim to know that the explicit odds of winning are the same, but they have a preference, characteristic of the third quadrant, for the container with the highest number of winning balls.

The latest developments in neuroscience have for the first time made it possible to measure man's thoughts and sensations, opening the secrets of that black box which is the fundamental building block of any system and economic interaction: the human mind. Many economics scholars express curiosity about neuroscience, but at the same time they instinctively remain skeptical that this can bring substantial innovations to economic theory. The tradition of ignoring the psychological factor in the development of an economic theory is sometimes so deeply rooted that the increase in knowledge about the functioning of the brain seems unnecessary in this area. Economic theory will likely continue to develop successfully in the coming years without paying due attention to cognitive neuroscience in general, but it is difficult to believe that so much scientific evidence cannot help explain some striking anomalies, and in particular all those anomalies that they have been the subject of debate for decades.

There are still many dark areas in our understanding of the subjects' intertemporal choices. In the US, the average credit card debt is $5000 per family and a million people have gone bankrupt in recent years alone. Healthy food is cheaper and more widespread than ever, however the expenditure for dietetic products and that for fatty products are both growing. Surely, understanding how brain mechanisms process reward and produce compulsive attitudes could help explain these facts and contribute to a regularization process. The models we have do not provide a satisfactory explanation of how individuals differ from each other; we can only characterize people as impulsive or reflective, determined or indecisive, stable or neurotic, mature or immature, depressed or optimistic.

Standard economic theories rest on the assumption that controlled cognitive processes are the key to economic decision-making processes. From our point of view, these models should respect the fact that brain mechanisms arise from the combination of automatic and controlled processes, which operate using the emotional and cognitive parts respectively.

6 Measure the Emotional and Cerebral Components of the Decisions

The various brain processes relevant in decision making have so far been described. What we want to illustrate below is how we can somehow measure the decision-making process and the emotions related to them during the visit of a store, during the use of a communication, while browsing a website, when associating corporate values with certain brands. In this way, in fact, brain and emotional activity is related to the specific events that occur during the use of marketing stimuli. For example, measuring the emotional level before the decision to buy a product, or before removing a product from the shopping cart becomes important and tells us about the mechanisms for accepting or rejecting the goods offered on the shelf inside the store.

Among the various neuroimaging methods available, the measurement of brain electrical activity by electroencephalogram (EEG) has several advantages. In particular, the EEG has a low cost, it is a wearable device and also through a network of electrodes arranged on the head it allows you to follow brain activity with high temporal resolution. The latter property allows you to carefully study the consumer response when viewing an advertising spot, browsing a website or visiting the store. The latest commercially available models of these devices are non-invasive, portable and made up of dry electrodes (Di Flumeri et al. 2019). These EEG recording systems are characterized by extreme portability and comfort for the user: there are systems whose number of electrodes can reach a maximum of eight, the connection and synchronization with the management device takes place wirelessly and the interference with users' activities is therefore minimal, allowing their use even outside the laboratory spaces and therefore, directly in the place where the consumer finds himself having to carry out his own choice and consumption activities.

In addition to brain activity, measured by EEG, it is also possible to characterize the emotional processes that occur during the use of the same stimuli by measuring the alteration of physiological body markers such as heart rate (derived from the electrocardiogram, ECG or photoplethysmograph, PPG) and the activity of the sweat glands of the hand (Galvanic Skin Response, GSR). These "somatic markers" are closely related to the variation of the emotions perceived by consumers during the interaction with marketing stimuli (Vecchiato et al. 2014). In particular, by extracting specific components of the markers and combining them one can characterize the value and intensity of the emotions, providing an Emotional Index (IE) that describes the emotional state experienced by the consumer during the experience. Also in the sector of PPG and GSR recording systems we find several devices with a high degree of wearability and invasiveness minimization.

This type of sensors implies a price to pay in terms of accuracy of the measurements provided: this limit, however, can be overcome thanks to the support of machine learning algorithms and thanks to the coupling of the measurements provided by this type of sensors with other "accessory" signals, such as the frequency of eye-blinks (Borghini et al. 2019), which can play the role of proxy related to the mental and emotional states to be evaluated. Again in this context, methodologies

that imply a further reduction of invasiveness, such as those that do not involve any contact with the user, deserve mention: this category includes the algorithm for estimating heart rate (HR) and eye-blink rate (EBR) by analyzing the user's facial video in real time (Rahman et al. 2020). The indices deriving from the signals abovementioned (EEG, ECG, GSR and EBR) are also closely correlated with the level of stress of the consumer, as well as with his emotional state. In addition, it is possible to use another particular device capable of returning information about the direction of the gaze of the consumer, to understand which particular product or stimulus is considered or attracts the most attention during the purchase decision, during the interaction of a web page or what aspect of communication is most noticed during an advertisement. This device is called eye-tracker and is able to collect the movement of the eye-gaze with a frequency of 30–60 times/s. In this way it is possible to collect "where" and "what" the consumer searches within the shop, for an advertisement, for a website, at the same time measuring the brain activity related to this search. There are two types of eye-tracker based on the context in which they must be used: in a context in which the use of a stimulus is requested from the computer (press images, advertisements, websites) a fixed eye-tracker is often used (Fig. 3) placed under the PC monitor, while if you want to trace the eye

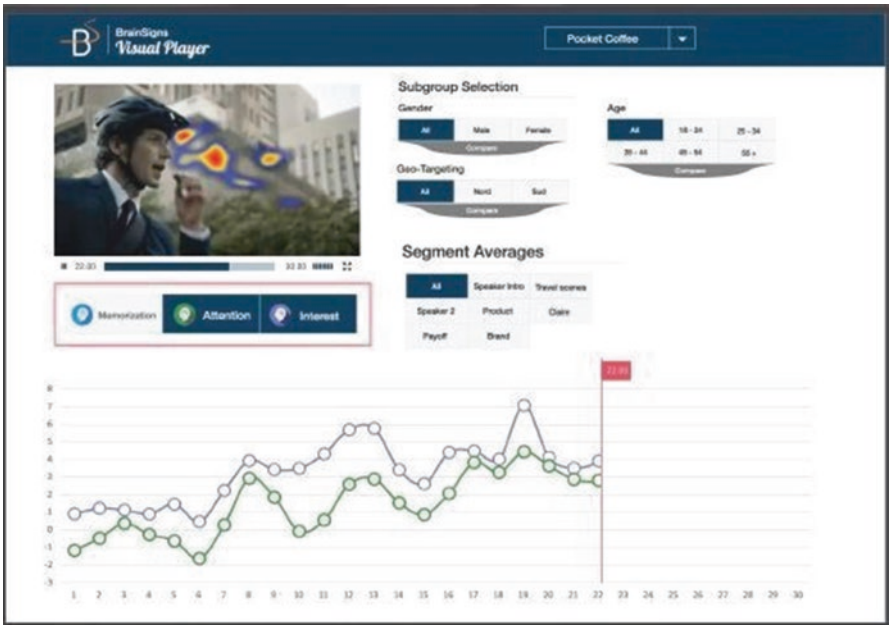

Fig. 3 Example of the neuromarketing test outcomes for the evaluation of an advertising spot. It is possible to observe the temporal development of the attention and interest indicators, second by second, while the test spot is reproduced in the upper left. The colored spots are related to the distribution of visual attention (heat map). This analysis can be done by communication segments (Intro, Brand, Testimonial, Product etc.) and by subgroups (Men-Women, Young-Adults etc.). Courtesy of BrainSigns (www.brainsigns.com)

movement while exploring exhibition spaces (sales points, museums, open spaces etc.), you use a mobile eye-tracker, similar to glasses (Fig. 3). In both cases, the eye-tracker instrumentation uses an infrared system: a light is directed towards the pupil creating detectable reflections, which are traced by an infrared camera. Lately, it is also possible to use "webcam" eye trackers that do not have special sensors or cameras, and do not work based on the principle of corneal reflection of the pupil center, but work through the webcam device connected or embedded in a computer, with support of a specific software.

Through the eye-tracker system it is possible to obtain various information, both quantitative and qualitative. The former includes fixations, which occur whenever a characteristic of interest is positioned on the fovea for a variable period and between approximately 150 and 350 ms; the latter include heat maps which represent the spatial distribution of fixations and indicate which areas of the image/advertising/product/web pages are most observed. From this instrumentation it is also possible to obtain other metrics such as: the scan path or gaze plot (sequence of fixations), the duration of fixations in specific areas of interest (AOI), the time required until the first fixation occurs in a specific AoI (Time to First Fixation) (Pozharliev and Cherubino 2019).

7 The Neurosciences Contribution to Marketing and Communication—Deepening of Specific Neuromarketing Applications

Neuromarketing applications have grown significantly in recent years in every area of marketing, such as communication, product, packaging, brand, retail and prices. The following section will explore some of these areas and in particular: advertising communication, customer experience in the store and brand evaluation/perception using implicit tests based on response times.

8 Evaluation of the Advertising Communication Effectiveness

Advertising is the marketing area that has benefited most from neuromarketing techniques. The evolution of the company has allowed access to advertising communication to a large number of advertisers, with the result that today we are surrounded by thousands and thousands of advertisements and companies to succeed in winning the attention of the audience resort to the most various creative techniques and tricks. In the USA, it is estimated that the average of the advertising proposals that a consumer encounters can reach 2000/day. In our country there are no studies as precise, but it is thought to be more than 1000. We are all consumers,

who buy a cell phone, a cream or a Coca Cola, shopping makes up a large part of our daily lives. And for this, every day, we are all "bombarded" by dozens, hundreds of messages sent by marketing and advertising in the form of TV commercials, billboards, banners on the internet, shop windows, brands. Brand information comes to us constantly, from all directions with a high frequency. But, with this high advertising pressure to which we are exposed daily, how can we think that everything can be memorized? What determines what information reaches our conscience and what instead ends up in the "dump" of our brain full of advertisements that have instantly fallen by the wayside and other equally immemorial consumer experiences? We know that the company that manages to understand and predict how its consumers will respond to different product versions or at different price levels will be able to obtain a significant competitive advantage over competitors.

But what information can be obtained when testing an advertising communication?

Through the application of neuroscientific techniques, it is possible to:

- Evaluate the effectiveness of advertising communication in terms of attention, interest, memorization, cognitive commitment and emotion, second by second (Fig. 5) and by specific segments (logo, testimonial, product, payoff etc.);
- Evaluate the different emotional and cognitive impact in the perception of advertising communication for different subgroups: user and non-user, men and women, young people and adults, different geographic areas (e.g., north, centre, south);
- Obtain indications for spot reductions in the spot: from a 30″ to a 20″ or 15″ version, identifying the best performing parts or elements that generate confusion and/or aversion;
- Analysis of the impact of repeated exposure, to estimate the opportunity to see (OTS) and the optimal GRPs (gross rating points);
- Discover the distribution of visual attention on the video or images and the weight of the different areas of interest on communication.

It is possible to examine which emotions are caused by particular advertising scenes, which elements of advertising users have paid particular attention to, or which have been remembered (Borawska 2016; Piwowarski 2017; Nermend and Piwowarski 2018).

At the following link https://goo.gl/Cnyo7T it is available the complete video of an advertising spot testing in its various phases, from the reception of the participant to the research to the way of representing the final results contained in the report to be delivered to customer.

In addition, these technologies can be used to test not only commercial but also social communications (Public Services Announcement, PSA) or non-profit organizations, NPO. The rules that determine the effectiveness of social advertising are comparable to those for evaluating commercials. Advertising is effective when the recipient notices and remembers a content that is the intent of the message (organization logo, product name, name of a candidate in the elections, desired social behavior, call to action, etc.). If the result is different, it means that an ad is not very

effective. The vast majority of social advertising is based on emotions, and these are usually messages associated with fear or compassion. NGOs are often told that they need an emotional appeal to attract funding, but what kind of emotional appeal? Fear (Fear Arousal Appeal) is usually used in social campaigns that focus on caring for yourself or on the well-being of your family (giving up smoking, driving safely, etc.), while compassion is present when you should help others (donate blood, help hungry people, etc.) (Rogers et al. 1997). However, heavy messages of guilt can produce an ineffective reaction when using too negative images or, at the same time and similarly, eliciting only positive emotions can have a negative effect.

In any case, the public service announcement (PSA) evaluation methods are often performed a posteriori, while adequate pre-testing of the PSA material would be extremely useful to verify the impact of the particular creative solutions on the target populations. It may be interesting to understand whether the evaluation of PSA (for example, effective or ineffective) can be carried out through the study of the neurophysiological reaction to exposure to the PSA itself. It could be hypothesized that possible different brain models could be obtained in response to different types of PSA (for example, effective or ineffective) or in the perception of consumer gender differences when observing charity campaigns using neurophysiological measurements (such as the EEG) (Martinez-Levy et al. 2017).

PSAs are at the heart of many public health campaigns against smoking, junk food, alcohol abuse and other possible threats to citizens' health. But the content of these PSAs could also be directed towards promoting "positive" collective social behaviors, for example, promoting campaigns against racism, supporting the integration of different cultures in the country, or promoting a healthy driving style, for safety road. Therefore, effective PSAs provide a great public health benefit (Biener et al. 2000; Emery et al. 2005). Using neuromarketing tools, several studies have been conducted in recent years to develop more effective social campaigns, such as promoting encouragement to use seat belts in cars or promoting smoking quit with anti-smoking campaigns (Orzan et al. 2012; Fortunato et al. 2014; Cartocci et al. 2016, 2017, 2018; Rossi et al. 2017; Modica et al. 2018).

9 Product Definition and its Optimal Positioning at the Point of Sale

The presentation of new products on the market represents one of the fundamental moments of marketing. However, despite the fact that the entire life cycle of the product is important, it is crucial for a company not to miss the launch of a new product, considering also that the reaction of consumers is extremely difficult to predict. Traditional market research alone is unable to predict actual consumer behavior. What emerges from countless bankruptcy launches is that companies often fail to predict how consumers will react to the new product, because what consumers say they feel or feel in pre-launch marketing research often turns out to

be very far from the purchasing behavior that they will have in the future and this can definitely be misleading for companies. This is the reason why about 80% of the new product launch is withdrawn within the first 6 months of life, and this percentage increases if we refer to the Asian markets (in Japan, the withdrawal of new products is even higher: 9 out of 10).

Neuromarketing could represent a solution to all this. In fact, its contribution is important in all phases of the product development cycle, including the launch phase. Entering neuromarketing in a "pre," definition, prototyping phase, certainly can provide valuable help for a deeper and deeper understanding of consumer needs.

Through sales channels, consumers do not seek products only for material benefits, but also evaluate them in terms of "experiences" connected to them. The place of purchase and the display of products inside it play a crucial role in the purchase phase. It is no coincidence that in recent years there has been more and more talk about shopping experiences, in which advanced selling (Cherubini and Pattuglia 2010) is enriched with digital, emotional and therefore experiential elements. The shopping experience becomes fundamental and the need to make it as pleasant and engaging as possible has become central. From traditional marketing (Kotler 1974) we know that the stores must be able to create an atmosphere aimed at inducing and stimulating emotional processes in consumers to increase the probability of purchase and improve consumer experiences. This is why the shopping experience must be better designed with the aid of effective measuring tools, which can assess sensory perception based on the most up-to-date neuroscientific discoveries. Surely, in a retail environment, buyers' emotional and cognitive reactions can provide useful information on packaging, on the display of the product on the shelves, on the behavior of in-store consumers by mapping their behavior, measuring their unconscious reactions and even interviewing them about their opinions. Listening to their reaction thus becomes complete and allows you to identify the best levers to make the shopping experience exciting, engaging and memorable, reducing the stress associated with purchasing and increasing the quality and time dedicated to entertainment and exploration.

At international level, present in Italy under the name of the Retail Institute, there is POPAI, which is an association for marketing and retail, whose goal is to promote the culture of the store as a whole, spreading the awareness of the strategic value of retail activities within the marketing mix. POPAI, born in the USA in 1956, conducted an impressive research in 2012 to investigate the shopping habits of consumers within the retail outlets, observing how the in-store decision rate has increased dramatically reaching a percentage of about 76% (percentage destined to increase). For this study, in addition to the administration of around 2400 pre and post-experience questionnaires/interviews, 210 people were involved, who were made to wear a portable EEG, an eye-tracker and the instrumentation to measure biofeedback responses (Fig. 4).

At the following link it is possible to have a summary of the research results https://goo.gl/iHpR1V.

In Italy, Cherubino and colleagues in 2017 investigated the brain activity (through the EEG) and the gaze (through the ET) of some individuals who were visiting a

Fig. 4 A participant involved in a POPAI's marketing research

Fig. 5 Consumer equipped with an EEG device (blue strap) and an eye-tracker device. The EEG device stores the brain data acquired during the decision-making process generated in the shop; the eye-tracker device collects information on the gaze of the eyes during the selection phase. Image courtesy of BrainSigns (www.brainsigns.com)

specific areas of a supermarket (Fig. 5). Participants focused in particular on the purchase of some products in the fruit and vegetable department. Research results have shown how neurophysiological tools can be used to obtain information that would otherwise not be obtainable with verbal interviews alone. The main results showed that the elements that made the shopping experience more pleasant were the following:

1. Innovative packaging and countless graphic customizations.

2. Better organization of the shelf (which allows an easier customer experience with a low mental effort index value).
3. Presence of the farmer outside the shop to promote his products.

These elements all returned higher neurometrics in terms of the participants' cognitive approach to the experimental context and greater visual attention.

10 Measurement of Unconscious Resistances

To measure the perception of the brand, the degree of positivity or negativity associated with the values it transmits, it is possible to use indirect measures based on response times, through a categorization task during which two or more stimuli are compared.

In order to overcome the lack of instinctive and unconscious knowledge of consumer behavior based so far only on questionnaires, psychologists have developed some techniques that are based on non-declarative characteristics of people's responses (Gregg and Maison 2016). This approach measures the response times of consumers and their accuracy, on tasks that are systematically influenced by their reactions to brands or advertisements and measures the attitude of the buyer. The implicit associations are linked to unconscious automatic attitudes that can be critical for the consumer's decision to purchase products/services (Gani et al. 2015).

Implicit Reaction Time Test (IRT) has a long history, but the Implicit Association Test (IAT) was first introduced into scientific literature in 1998 by Anthony Greenwald and colleagues (1998) to measure individual differences in implicit cognitions. In the beginning, IAT was used to study racial attitudes, self-concept and self-esteem. Currently, IAT is used in various areas, including consumer attitudes towards brands, products, services that explicit measures are unable to detect, and can be considered a neuromarketing tool. In particular, the IAT measures the underlying attitudes (assessments) of the subjects by evaluating the reaction times on two cognitive tasks, identifying the speed with which they can associate two different concepts (stimuli such as advertising, brands, products) with two different evaluative anchors (attributes). As he states (Zurawicki 2010), measuring the reaction (or response) time between the appearance of the stimulus and its response can inform researchers about the complexity of the stimulus for an individual and how the subject relates to it. A shorter latency time in recognition or association (of positive or negative adjectives) to a stimulus indicates a more rooted attitude towards that particular stimulus. Although the response difference is a few milliseconds, this is a very effective indicator for assessing preference.

Therefore, these methods measure the strength of the associative links between concepts represented in memory and are generally based on a simple categorization task that the participant must perform on the computer (Fig. 6). For each test, a stimulus appears in the center of the display and must be classified as quickly and accurately as possible. Various stimuli then. Appear, generally words or images and,

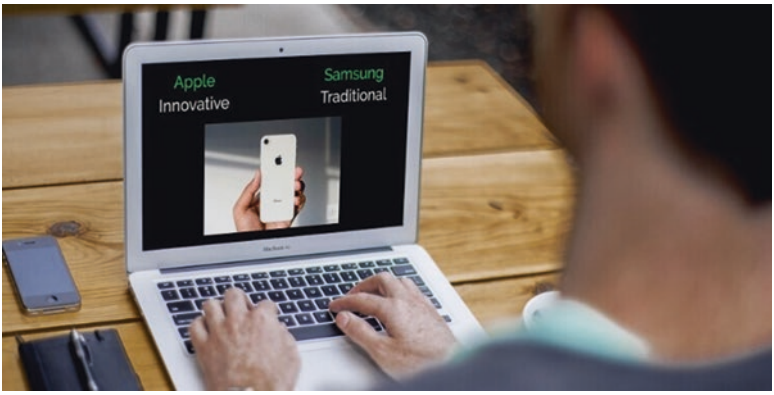

Fig. 6 A participant carrying out an Implicit Association Test (IAT)

each stimulus belongs, in the common knowledge heritage to only one category. The task of categorization in the presence of a certain stimulus will be the faster the more there is a strong mental associative link on an unconscious level between the stimulus and the task or between the stimulus and the reference concept defined in the test.

Psychologists have been using these tests for nearly 40 years, and published academic literature has shown that, in many different sectors or fields, when implicit tests are in contrast to explicit answers provided by subjects at the time of the test, implicit tests have proven to be more precise in predicting subsequent behaviors.

This has been proven in many contexts including:

- Consumer choice (Carney and Banaji 2012)
- Personal skills and performances (Filipkowski 2012)
- Stress response (Quirin et al. 2009)
- Adaptation/Change of job (von Hippel et al. 2013)

IRTs are now used by companies around the world to find out what their customers really think and feel about their brands, products and services. They are also used for internal company climate assessments, in training courses and where it is important to understand the reason for some unconscious resistance.

Here are some of the questions that can be addressed with IRTs:

- What are the brand attributes most strongly associated with my brand?
- What is the probable acceptance of a new logo?
- Will the new logo be strongly associated with the brand values you want to communicate?
- Which new product prototype will the consumer accept?
- Which packaging design implicitly communicates the benefits of my brand?
- What are the brand attributes evoked by different sounds?
- Which media platform is most effective for my creative execution?
- What are the most engaging facets of my website?

- What are the main unconscious resistances of my sales network?
- What is the attitude of my customers or employees in adopting new technologies?
- What is the attitude of my customers or employees in adopting smart objects and/or robots?
- What is the attitude towards changes?
- What is your attitude towards leadership?

This list is almost endless. The approach lends itself to almost all marketing questions (or even from other sectors). It always depends on the research question and the problem that companies face and which can be investigated with the measure of unconscious resistance.

11 Conclusions

It has become evident in the scientific literature that the possibility of measuring emotional and brain activity in consumers during their visit to a store and, in general, outside the laboratories, will open up new fields of research, in order to better understand the brain processes underlying the purchase decision that is generated in the usual places of interaction.

While until a few years ago, the devices capable of acquiring this information were cumbersome for the consumer, forced to carry around during the visit, a fairly heavy computer on the back of the shoulder, the situation today appears to have improved a lot. Today, in fact, light devices for the acquisition and analysis of EEG signals are available which can also be used during the visit of shops, museums and other educational or entertainment places (such as cinema, theater etc.), as shown in Fig. 7. In the figure above, equipment used for the collection of brain and emotional activity, for tracking the gaze, is used during the visit of an art exhibition. In the near future, the device for the collection of brain and cardiac activity will be even lighter, the size of a modern smartphone, and will return the consumer's perceptions in real time during the act of purchase in the shop or during the use of one stimulus (Fig. 8).

Furthermore, thanks to technological advances, it is now possible to measure people's cognitive and emotional perception during virtual reality (VR) experiences. Such technology allow to reproduce an environment very similar to reality but with obvious economic advantages: the creation and customization of the environments by changing the color of the furnishings, the positioning of the products, the brightness, the music etc., which would be more difficult to replicate live. VR is a system that arises from the combination of hardware and software devices for the creation of a three-dimensional virtual space (which is therefore simulated and does not exist) within which the user can interact and move freely.

The virtual environment, built through specific computer software, can be explored by wearing a specific VR viewer. Furthermore, it is possible to interact, with the help of specific accessories (controller, gloves, earphones, etc.) with the

Fig. 7 The figure shows the collection of brain and emotional activity while visiting an art gallery. Note the eye-tracker device for measuring the gaze pointing as well as the device for collecting EEG signals on the subject's belt. Image courtesy BrainSigns srl (www.brainsigns.com)

Fig. 8 The figure shows the collection of brain and emotional activity during the interaction of a website using wearable equipment

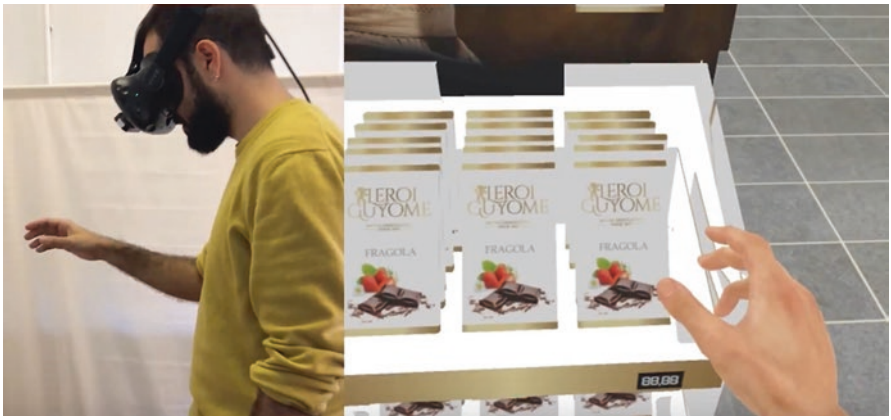

Fig. 9 A participant while performing a task of purchasing a product inside a virtual supermarket. Courtesy of BrainSigns (www.brainsigns.com)

elements present inside the VR, making the experience even more engaging and immersive. There is also a device, a small USB device (LEAP, produced by the Leap Motion company) that can be integrated into the viewer and which is able to identify the fingers of the hand so as to allow the taking of objects in the virtual environment (Fig. 9).

Everything becomes very real, as the user could freely move and explore the environment in all its parts. In addition to being widely used in gaming for recreational purposes, it can also have a cultural and popular value. It allows to visit exhibitions, museums, archaeological sites, but also to create mock-ups of supermarkets, trains, planes and any useful interaction space for the user. This system can be integrated with EEG, HR, GSR and eye-tracker technologies to obtain more accurate information on emotional and cognitive responses during the use of particular environments and the execution of specific tasks (Pozharliev and Cherubino 2019).

Finally, a clear and promising direction for the future is the bridge between the measurements of people's internal states in relation to the perception of marketing messages and the science of data related to the effective behavior of hundreds of thousands of them (for example, the big date). We hear so much about big data and their enormous potential to obtain information useful for strategic decisions. One of the most complex aspects to evaluate will be the fusion between the information generated by human beings and the information generated by robotic machines, or by smart objects or the Internet of Things. It will be important to understand how to integrate this data. There are models with which from the analysis of environmental sensors installed in the home or that derive from devices that we wear (think of smartwatches), it will be possible to reconstruct decision and behavioral models for marketing choices and, with the data collected by these devices, it will be easier to have real, truthful and more precise information than the similar ones collected, e.g., via the web (e.g., social media).

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Free Time as a Non-market Good: Methods of Its Valuation

Danuta Miłaszewicz

Abstract Market goods, i.e., those which are traded on markets, have their value determined by their price. Price is the main determinant of the decision to buy or sell such a good. Non-market goods, i.e., goods that are not traded on the markets, do not have their price determining their value. However, economics has developed various methods that directly or indirectly determine the value of non-market goods. These methods are used to determine the value of public goods (e.g., national defense) or common goods (e.g., the environment and its values), allowing decision-making on their creation, use or protection. However, free time is a specific non-market good which has its value, which should also be subject to valuation constituting the basis for decision-making on its use. The purpose of the chapter is to analyze the methods of valuation of non-market goods in terms of the possibility of their use in the valuation of free time.

Keywords TEV concept · Economic valuation · Free time

1 Introduction

Time is our most valuable resource, because it is certainly a non-renewable and the most scarce resource. Valuation of time should therefore be the basis for making decisions about its use. It is generally believed that time is money, but there is no single, universally accepted approach to the monetary valuation of time, especially considering the part which is not working time (time spent on work). The source literature describes three approaches to the valuation of free time: the opportunity cost concept (Becker 1965; Heckman 2015), the quality of life concept (Sendi and Brouwer 2004; Alpman et al. 2018) and the valuation of non-market goods concept, which is the subject of this chapter.

The valuation of time off from work is extremely important from an economic point of view, because we have a relatively large amount of this time, and its use

D. Miłaszewicz (✉)
University of Szczecin, Szczecin, Poland
e-mail: danuta.milaszewicz@usz.edu.pl

K. Nermend et al. (eds.), *Decision-Making in Management*, Contributions to Management Science, https://doi.org/10.1007/978-3-030-67020-7_9

affects many areas of family, personal and professional life which translates into economic and social processes in the macro scale. Recent studies show that in 38 OECD countries, a full-time employee has an average of 63% of the day time (around 15 h) that is not spent on paid work. This time is spent on personal care (food and its preparation, other household activities, sleeping, etc.) and leisure time and recreation (social meetings with family and friends, hobbies, games, computer and television, etc.) (OECD 2019). The leisure time and recreation are called free time in this chapter. The increase in the amount of free time over the last century is well documented. Currently, in 20 OECD countries, during a year, free time is longer than the time spent on paid work or study, and their ratio in these countries ranges from 1.03 (in the US) to 1.83 (in Italy) (OECD 2020).

While working time, one of the elements of the labor resource traded on the labor market, may be treated as a market good, having its value determined by the price set on this market, leisure time should be treated as a non-market good. There are no real markets for such goods, such goods do not appear on the markets, so the prices of such goods cannot be determined on the market (Kriström and Johansson 2019). Non-market goods do not have a fixed price, i.e., market value, which does not mean that they are of no value for people. Everything that is assessed by people as valuable has its value. Therefore, the value does not have to be disclosed directly on markets.

A value expressed with a price is considered as a proper equivalent in money and represents the sum of money that would have an equivalent effect on the welfare or utilities of individuals. It serves as an instrumental or external value of goods, which are bought because of their utility. Instrumental value should be distinguished from intrinsic value. Some thing or quality have intrinsic worth, if it is valuable in and for itself—if its value is not derived from its utility, but is independent of any use or function it may have in relation to something or someone else or having an unavailable supersensible, or a signature value, or moral value (Freeman 2003: 8; Ronnow-Rasmussen and Zimmerman 2005: 428; Bhagwat 2009; Zimmerman and Bradley 2019). Intrinsic value lies in the good or well-being of all living entities and these nature's advantages can be compared to the benefits that make up human well-being (Davidson 2013: 172; Dushin and Yurak 2018).

For individuals, with no doubts, free time has both instrumental and intrinsic value, because for an individual, time has a certain value which arises from mere existence. Scientists agree that intrinsic value cannot be monetized (Zimmerman and Bradley 2019), therefore instrumental value, and, in particular, the economic form of instrumental value is important from the economic point of view. To assess the economic instrumental value of a good, it is necessary to specify a goal and to identify the contributions that specific components of this good make towards the furtherance of that goal. Economics focuses on human needs and the ways of satisfying them in the conditions of limited choice and identifies the increase in welfare (or more broadly, well-being) as the main goal of making any decision. Thus, the economic theory of value is based on the ability of goods to satisfy human needs and desires, leading to the improvement of individuals' well-being or utility. Therefore the economic value of something (a good) is a measure of its contribution

to a human well-being, who motivated by own preferences makes an assessment (costs and benefits) and ranks various options. These preference orderings are characterized by substitutability and an individual choses an option, which guarantees the largest contribution to well-being (maximizes well-being). Substitutability is at the core of the economist's concept of value because establishes trade-off ratios between pairs of goods that matter to people. The trade-offs that people make as they choose, reveal the values that people place on these goods. If at least one of the goods has a monetary price, the revealed values can be identified as monetary values. The substitutability assumption underlies most of the models of individual choice that are used to analyze and predict a wide variety of economic behavior both inside and outside of markets (Freeman 2003: 11).

For quite a long time, the assumption that goods have usability value only for their buyers and that there is no interdependence between the preferences of individuals was a typical practice of the cost-benefit analysis. Now, it is believed that there are different dimensions of value, and the assumptions of individualism and self-interest do not exclude altruism or individual concern for the welfare of other people. The anthropomorphic nature of considerations does not exclude concern for the welfare of even other species. The existence of other dimensions of value, apart from use-value, noticed by economists, was reflected in the concept of Total Economic Value (TEV). Therefore, in the extended cost-benefit analysis, where various methods have been applied, attempts are being made to value TEV in money, which is a well-known, comparable and the continuous unit of measurement, accepted as the best form of expressing all dimensions of value for comparison (compare Freeman 2003: 11; Kumar 2016: 2).

The objective of this chapter is to analyze the usefulness of the TEV concept and methods of valuation of non-market goods in relation to the valuation of time, in particular free time. To achieve this goal, the method of critical analysis of the source literature and the method of deduction were applied. The considerations in this paper are divided into three parts. The first one presents the developing concept of TEV, the second includes the proposed and applied methods of its monetary valuation in relation to non-market goods, and the third characterizes the essence of free time and assesses the usefulness of these methods for its valuation.

2 Total Economic Value

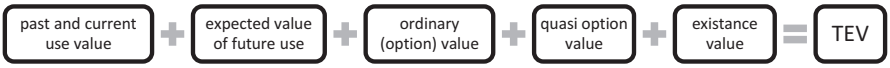
In the early twentieth century, economists, quitting cost theories of value (based on land or work), concluded that value, reflecting people's choices, indicates how a given good satisfies human needs. Thus focusing on the category of value, they noticed its relation to the utility of goods, and basing the traditional assessment of goods solely on the value in use attributed to goods, they took into account only direct benefits for end consumers. Instead, the modern approach to economic value is based on Total Economic Value (TEV), which became the grounds for the development of various methods of monetary valuation of non-market goods. This

concept is one of the most commonly used and widely accepted framework for classifying the economic benefits of non-market goods (and resources) and an attempt to incorporate them into the decision-making process. The main innovation is that it takes into account not only material and market values, but also other dimensions of value, functions and non-use benefits of goods (and resources). Thus, the TEV concept ser ves to overcome the problems of underestimating the various dimensions of value that conventional economic analysis and decision making have to cope with. (Cavuta 2006; Emerton 2018: 2127; Dushin and Yurak 2018).

The TEV concept divides total value generally into use value and non-use value. The use value refers to the tangible qualities of a good that can satisfy certain human requirements, desires, or needs and that serve a useful purpose. Any use of it, at any time and by anyone, creates use values that are more or less measurable as they come from the current use of a good (Cavuta 2006). The use value arises from the specific application of a given good, therefore it should be measured with the degree of satisfaction of specifically reported needs.

The threat that appears when analyzing economic values is reducing them only to the criterion of utility, and yet TEV is also non-use value referring to internal benefits, emotional values, uniqueness, uncertainty and irreversibility, playing a major role here (Pearce and Turner 1990: 132; Cavuta 2006; Drenda 2016). In line with these characteristics, some people are willing to pay for a given good to exist. The category of non-use value captures those elements of value that are unrelated to any current, future or potential uses (Dziegielewska 2013). Thus, economic and material values should never be analyzed in isolation from affective values, because only understanding their mutual overlap allows for a comprehensive assessment of the entirety of a given good (Drenda 2016).

While referencing to the origins of the TEV concept in the scientific literature is virtually impossible, it is most likely that the phrase "Total Economic Value" first appeared in the work of G. L. Peterson and C. F. Sorg (1987: 5–6) entitled „Toward the Measurement of Total Economic Value". It was proposed to identify and measure the total value as the sum of its components, which included four classes of use values on the basis of the timing of the use decision (past or future), the uncertainty that attaches of future use and the value that attaches to delaying irreversible decisions about use if new information is expected to become available letter, and existence value (non-use value), which means, that:



This paper noted that the existence of non-use values has been elucidated by J.V. Krutilla (1967), who pointed out that the existence value representing the satisfaction that an individual gets from knowing that a good or source will be preserved,

independently of any personal present or future use.[1] G. L. Petersona and C. F. Sorg (1987: 7) also highlighted that in the source literature that suggested various motivations and forms constituting the existence value, many definitions exist and this total value dimension does not appear to be bounded relative to other values, such as use values (Peterson and Sorg 1987: 16)

In the following years, the term of Total Economic "Value" was more and more used by other economists, especially those dealing with environmental protection and ecological economics. The term was publicized mostly by D. Pearce, R. Turner (1990) and D. Pearce, J. Warford (1993). According to D. Pearce and R. Turner (1990: 130), the use value is identical to instrumental value, while the non-use value is identical to intrinsic value. That time, they included actual use value and option value[2] in the use value and agreed that non-use value is equal to existence value, what meant that

According these authors the option value is the sum of value in use by the individual, value in use by future individuals and value in use by others (vicarious value to the individual). They understand the option value as a difference between the willingness to pay (option price that is above the market price) and the expected consumer surplus, which is equal to the relevant consumer surplus because decisions are made on the basis of what is expected (Pearce and Turner 1990: 132). The existence value is certainly fuzzy value and it is not very clear how it is best defined, but is related to conditions of irreversibility, uncertainty and uniqueness (Pearce and Turner 1990: 131).

D. Pearce and J. Warford delivered another understanding of the TEV. In the research "World Without End: Economics, Environment, and Sustainable Development" (1993: 5) they presented use value as the sum of actual use value and option value. The actual use value is a sum of direct value, indirect value and option value, which means that:

[1] J. Krutilla (1967) conducted an analysis in which he identified a larger concept of non-use value, which included, besides the option value, other two components: the existence value and bequest value. He defined the existence value as attributed by the economic subject without a link to a real or potential use of a good, but exclusively to its mere existence. He defined the bequest value as the value that an individual attributes to goods considering the use of the goods in the future by his heirs.

[2] According to B. Weisbrod (1964), who introduced the term "option value", it is a price that people are willing to pay for preserving the resource for its possible use in the future and he offered to summarize this kind of value with expected benefits from various alternatives.

The direct value (also known as direct use value or actual use value or current use value) appears due to a direct use of a specific good, while the indirect value (sometimes called production support value) results from indirect use and means the use of a specific good through using the other one. Option value is the amount that individuals are willing to pay in order to conserve goods or resources for their future use. The option value resembles an insurance premium for provision of a good (resource or service) which availability in the future is an uncertain quantity. Option value is not necessarily positive, as the preferences of future generations and the availability of natural resources in the long term are not exactly known. Quasi-option value is the value of information that arises after the choice has been made to conserve or develop now. Existence value relates to valuations of the assets that are unrelated either to current or to optional use. Empirical measures of existence value can be obtained using questionnaires (conditional valuation method) (Pearce and Warford 1993: 4–5).

D. Pearce and J. Warford (1993: 7) emphasize that the components of TEV cannot simply be aggregated and before being added to the equation, components must be demonstrated not to be mutually exclusive. In practice, then, the TEV approach must be used with care, but exploring these approach helps investigate economic value.

These three approaches of TEV have become the base for other researchers studying the total economic value of various goods or resources. Since then, many approaches have been presented to define the TVE structure and the links between its components, therefore there is no single standard categorization nor terminology of TEV in the literature and there are several variants of its detailed structure. Each of these variants is based on the assumption that TEV consists of the use value and non-use value (e. g. Emerton and Bos 2004: 26; Pearce et al. 2006: 85–87; Plottu and Plottu 2007; Pascual et al. 2012; Drenda 2016; Żylicz 2017; Dushin and Yurak 2018). Various subcategories of the total value are recognized depending on the needs resulting mainly from the object and purpose of the analysis, but also reservations are made to the distinguished components of the value. For example, critics state that option value does not exist, because its components are included in the use value and non-use value, as long as future (uncertain) benefits have been taken into account properly (Żylicz 2017). Others, however believe that capturing mostly direct and indirect use values, should necessarily include the option and existence value since some decisions transcend the individual horizon representing collective and community concerns to preserve the freedom of choice and the set of options (Rodriguez 2008). Other suggested that a complementary framework to assess the TEV is required based on a hierarchical rationality of choices since some decisions transcend the individual horizon representing collective and community concerns to preserve the freedom of choice and the set of options (Plottu and Plottu 2007).

The direct use value is frequently divided into consumptive uses and non-consumptive uses (Cavuta 2006; Blignaut et al. 2008; Eppink et al. 2014; Saayman and Saayman 2016). The non-use value (sometimes called passive use value) includes:

– existence value,
– bequest value (or legacy value) and
– altruistic value (or vicarious value).

The first one reflects benefits related to satisfaction that a given good exists, the second one refers to benefits from ensuring that certain goods will be preserved for future generations, and the third one results from that people attribute them to goods or services which have no value to them but may satisfy the current needs of other people or even species (Cavuta 2006; Pearce et al. 2006; Plottu and Plottu 2007; Pascual et al. 2012: 197; Dziegielewska 2013; Baveye et al. 2016; Dushin and Yurak 2018; Paul et al. 2020). These TEV components are shown in Fig. 1.

Referring to the concept of sustainable development, the literature also indicates that direct use values refer to the economic dimension, those of indirect use refer to

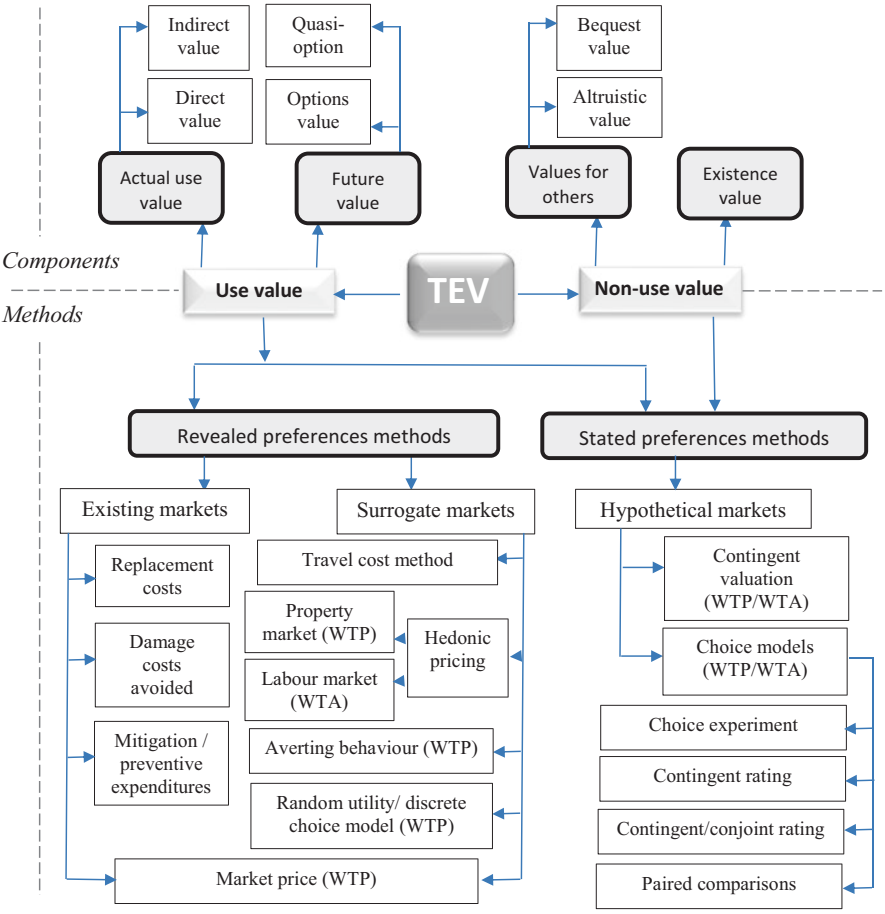


Fig. 1 Total Economic Value—components and methods of valuation. Based on: (Pearce et al. 2006: 87–88; Emerton 2018: 2128–2129; Dushin and Yurak 2018)

the ecological dimension, and the vicarious and legacy values are linked to the social dimension. As the sustainable development aims at reaching a compromise among its three distinguishing dimensions, the total economic value should consider the trade-off of its parts (Cavuta 2006).

3 Valuation Methods for TEV

The theoretical concept of TEV is a multidimensional, holistic structure that shows how complex the issue of the full valuation of various goods or resources is. In parallel with the advances in defining and conceptualizing TEV, techniques for quantifying values and expressing them in monetary terms have also evolved over the past decades. Currently, researchers interested in the TEV topic go beyond the theoretical analysis of total economic value and its components. Their attention is focused on empirical analysis, which allows to identify not only the main features, especially the various subcategories of non-use values, but also various methods useful for their measurement. The applied methods of monetary valuation depend primarily on the defined problem and the scope of the analysis. The choice of a specific method is also influenced by the nature of an analyzed good (goods), data availability, the degree of knowledge of various methods, but also the size of the research sample, the availability of time and resources, and the experience of those making the valuation (Balkiz 2016).

In estimates of direct value in use, market prices or contract prices are used to determine the monetary value of goods based on decisions made by consumers in the market. Economists have developed a range of approaches to estimate the economic value of non-market or intangible impacts. There are several procedures that share the common feature of using market information and behaviour to infer the economic value of an associated non-market impact. These approaches have different conceptual bases, which associate changes in the quality or quantity of goods with changes in the production of the goods or services being placed on the market ("production function" techniques), assess market trade-offs or avoided costs ("cost-based" techniques), look at how goods value is reflected indirectly in people's expenditure or in the prices of other market goods and services ("substitute market" techniques), or ask consumers for direct valuation („stated preference") (Emerton 2018: 2130–2131).

Methods of valuation of non-market values may therefore be based on surrogate and related markets where consumers disclose their preferences or in hypothetical markets where the individuals' preferences are not observed but rather stated (Freeman 2003: 21). The division into these two types of preferences is reflected in the classification of different methods of valuation of non-market goods, into two groups—indirect and direct methods—according to the nature of data generated for modeling and estimating (Champ et al. 2003: 21; Czajkowski 2010: 14–16; Sousa et al. 2019). The methods of both groups are based on a subjective theory of value and individual preferences expressed in money. They require establishing a

relationship between changes in the quantity or quality of a good and changes in the stated, observed or declared human behavior that are related to a change in the utility or well-being of individuals. The division of the methods used into these two groups is illustrated in Fig. 1.

Indirect methods are based on the observed behaviors of individuals, i.e., preferences revealed (revealed preference methods, RPM) by potential consumers and so-called surrogate markets (Clough and Bealing 2018: 12). RPMs analyze observed consumer behavior on the market to determine the monetary value that people attribute to non-market goods. A non-market good may constitute a direct argument of the consumer's utility function or it may affect the utility indirectly, e.g., if it is a factor of production of another good that a consumer buys on the market (Żylicz 2008). This approach to the valuation of non-market goods assumes that despite the fact that a given good is not present on the market, it can be associated with another market good having a price and thus the value of the analyzed non-market good can be identified (Boyle 2003: 260). Indirect valuation methods thus allow the collection of information on individual preferences for market goods that are related to the non-market good subject to valuation, as its complement or substitute (Kriström and Johansson 2019; Sousa et al. 2019). Therefore, they are an attempt to measure values indirectly related to the analyzed good, and thanks to these methods, non-market values can be estimated (Clough and Bealing 2018: 12). The valuation of a non-market good carried out using indirect methods, however, will not provide information about the non-use value of a good, because this value does not have to translate into any observable consumer activity and will not provide information on the valuation of non-market goods that have never existed (Żylicz 2008).

The direct methods of valuation of non-market goods are based on the stated preference methods (SPM). These methods are used when data from real markets are not available. They consist in the construction of a hypothetical market in which consumers choose something that does not actually exist on the market and is not tradable. SPM is based on asking people how much they value a given non-market good, therefore their basic assumption is that respondents are aware of the nature of a good being the subject of valuation (Boyle 2017: 84). SPM was initiated by Robert Davis, who was the first to show that if a good has no market price, its value can be determined by asking people how much they would be willing to pay to use it (Brown 2003: 100; Żylicz 2017).

Direct methods use surveys or questionnaires to estimate how much people would be willing to pay (WTP) to get a hypothetical non-market good or a specified alternative of a non-market good, or what monetary compensation they would be willing to accept (WTA) if they were deprived of the use of a particular hypothetical good or its specified quantity, or willingness to accept something not desired. The valuation is made on the basis of the direct answers to these questions given by consumers (not necessarily users) (Brown 2003; Żylicz 2017; Kriström and Johansson 2019). The WTP for the benefit or WTA a compensation for being denied the benefit is an economic measure of value, which reflect the choice pattern of all human-made, financial and natural resources given a multitude of socio-economical conditions as preferences, distribution of income and wealth, the state of the natural

environment, production technologies, and expectations of the future (Kumar 2016: 3).

They are based on responses to hypothetical questions, but the direct questioning has the potential to pick up values other than current use of particular goods (e.g., option values and non-use values). They can be applied across a broader sample of the population than those who currently use the goods (Clough and Bealing 2018: 13). In contrast to indirect methods, which allow to valuate only utility value, direct methods allow researchers to measure both the use value and non-use value components (values held by both users and non-users) (Parkkila et al. 2010: 36; Prūse 2015; Clough and Bealing 2018: 13; Sousa et al. 2019).

These are the most popular and the most frequently used methods for the valuation of non-market goods due to their universality (in many cases they are the only feasible valuation method) and flexibility (they allow for the valuation of goods not yet available in a market or in reality), thanks to the hypothetical choices presented to consumers. Valuations based on stated preferences are relatively easy in gathering proper data, directing monetary valuations and straightforward aggregation across individuals. They can be used in any research on consumer (or other entity) choices to identify and analyze the factors influencing these choices. These methods can be used to determine the total economic value of a good, including passive-use value (Carson et al. 2001; Czajkowski 2011; Carson 2012; Zawojska and Czajkowski 2017).

The revealed preference methods deduce willingness to pay from observed evidence of behavior when faced with real choices. The stated preference methods rely on deriving willingness to pay from choices made in hypothetical or constructed situations. Each of these techniques has its own assumptions, merits, and shortcomings (Kumar 2018a: 2120). Revealed preference methods have some advantages over stated preference methods in that they are based on the actual observed behavior of individuals. The economists assess them as more reliable (Brown 2003: 99; Żylicz 2017), but the values obtained with their use may be distorted by market imperfections and policy errors (Kumar 2018b: 2136). When using state preference methods, they may not give a properly estimated economic value because it is not clear whether respondents' behavior in real life when faced with real choices, costs, and benefits will be the same as expressed in hypothetical situations (Kumar 2018b: 2137).

4 Methods of Valuating Free Time as a Non-market Good

Free time is not easy to define due to the multiplicity of approaches used to determine its essence. According to K. Mastrothanasis and M. Kladaki (2020) two types of free time definitions may be distinguished: quantitative and qualitative. The quantitative definitions consider leisure time as the remaining time of working time. This time is not spent on paid or unpaid domestic work, study or personal maintenance (Fisher and Robinson 2010; Fisher 2015). Such perception of free time refers

to work as a central part of human life and to leisure as its antithesis, because it is undertaken at will and voluntarily (Davidovitch and Soen 2016). This is time when a person chooses an activity freely, following the inner commitment and motivation and decides to perform activities that do not affect its social partners and are not subject to social requirements or mandatory classifications (Davidovitch and Druckman 2017; Veal 2020). Definitions based on qualitative dimensions of free time indicate, however, its personal nature as well as the personal satisfaction of an individual through his involvement in activities emerging from personal interests. Free time is defined as permission to do what one likes at own pace, to participate in the activity of one's choice and to give it up at any time (Cordes 2013: 3).

Having regard to time valuation it is appropriate to combine both types of definitions reflected in the common-sense view of free time. According to R. A. Stebbin (2018) in everyday parlance, leisure refers both to the time left over after work and to non-work obligations—often called free time—and to the way in which that time is spent. With regard to the TEV concept and its distinguished components, free time brings both utility and non-utility values, which are usually not separated in research, regardless of the method of free time valuation. Table 1 presents the examples of the latest studies (published in the twenty-first century) including empirical research, where various direct and indirect valuation methods of free time value were applied.

Considering indirect methods based on revealed preference, one of them using surrogate markets is applied to free time valuation. The tourism market (tourist travel) is an example of a surrogate market and the applied method is the travel cost method (TCM). TCM is one of the oldest indirect methods. It was proposed in 1949 by H. Hotelling, who was the first to suggest that the value of a place visited by tourists can be inferred from the costs they incur to get there (Żylicz 2017). In general, travel cost methods utilize the fact that market and intangible goods can be complements, to the extent that purchase of market goods and services is required to access an intangible good. For example, people have to spend time and money on travelling to recreational sites, and these costs reveal some value of the recreational experience to those incurring them. The difficulty in this valuation is that a travel itself can have value, that the same costs might be incurred to access more than one site, and that some of the costs are themselves intangible (e.g., the opportunity costs of time or lost earnings) (Pearce et al. 2006: 19; Żylicz 2017). Data analyzed with the use of TCM are obtained in interviews with respondents and relate to decisions and behaviors they made in operating markets. Interviews can be conducted either with people visiting a given recreation place or in a group representative of a given community (Bartczak 2011: 12). The applicability of TCM is limited because it requires the user's participation in the entire process of valuation. It can be used only to find out the use value—direct and indirect (Zandersen et al. 2011: 14; Yadav and Sahu 2015).

In the case of direct methods based on the stated preferences and hypothetical markets, both contingent valuation (CV) and contingent choice (CC) are used for economic evaluation of free time (compare Table 1). The first use of CV method was noted in Davis's works of 1963 on the economic value of recreation in the

Table 1 Examples of research on the economic value of free time

Authors	Purpose of the study	Method	Main conclusion
Álvarez-Farizo et al. (2001)	Large variation in the value of free time	CM, Contingent Rating	The value of leisure time varies from person to person, while for a person time is assessed differently depending on how it is spent; time on-site is valued differently than travel time
Eom and Larson (2004)	The case of water quality improvement of the Man Kyoung River basin in the Chollabukdo province	Combining CV and Travel Cost Data	The value of leisure time is 90% of the market wage; higher opportunity cost of leisure time in Vietnam than in the USA, which was 50–60% of wages
Shiaw (2004)	Surveying passengers traveling between Taipei and Tainan, two major cities in Taiwan. Three types of public modes for passengers to choose: train, bus, and air	CM, Combining RP and SP Data	The value of leisure time was estimated at NT $56/h (approximately $1.65/h), which was even below the Taiwan government's minimum wage at the time.
Dalenberg et al. (2004)	Estimation of the hourly average value per marginal unit of each recreational activity (out of the 16 honored) of each respondent who performed this activity in the last year; adults in the Missoula, Montana urban area	Open-ended version of the CVM	The average hourly values per unit vary widely among activities of free time (from $26.04 for playing with pets to $1.07 for exercise/non-organized sports); leisure is very important to Missoulians; the estimated mean annual value of leisure per adult Missoulian was $21,751, which was 96% of personal income in Missoula
Hairong and Hongbo (2012)	Investigation of Chengdu residents' leisure time utilization	CVM	The leisure time value of Chengdu residents was 23.47 × 108 yuan, in which self—maintenance leisure time value was 5.47 × 108 yuan, entertainment time value is 13.92 × 108 yuan, and leisure time of social activities value is 4.08 × 108 yuan
Verbooy et al. (2018)	Lost unpaid work and leisure time of adults patients due to ill health; data collected with an online survey in the Netherlands	CVM	The average WTA value for leisure time was V15.86. The mean WTP value for leisure time was V9.37 when traded against unpaid work, and V9.56 when traded against paid work. Differences in monetary values of leisure time were partly explained by respondents' income, educational level, age, and household composition
González et al. (2018)	The recreational value of the Teide National Park	Discrete choice model	An important measure of the value of travel time is the opportunity cost of free time, not of working time; the time value depends on the mode of transport and the stage of the journey

(continued)

Table 1 (continued)

Authors	Purpose of the study	Method	Main conclusion
Buason et al. (2020)	The time spent on-site is endogenous, and WTP for this time is not zero; an example of an urban park in Iceland	TCM	The estimated WTP values are more than twice as high as the estimates of the standard single-site model

Maine woods (Carson and Hanemann 2005: 829). The author argues that real market behavior could be simulated in a survey by describing alternative facilities available to the public and then eliciting the highest possible bid (Hoyos and Mariel 2010). The CV method (CVM) uses questionnaire to identify individual, actual preferences for non-market goods. CVM is based on surveys conducted among respondents interested in a specific, non-market good (not necessarily users). The main task in CVM is to design a survey questionnaire, which elicits respondents' preference for the good being valued. The respondents are presented with a hypothetical situation of choice (scenario) on which they make their choices, and their answers are conditional on the acceptance of this plan and relate to WTP or WTA (Carson and Hanemann 2005: 825: Hoyos and Mariel 2010; Zawojska and Czajkowski 2017). Both values should be treated as equivalent to a hypothetical value. Questions asked to the respondents may be open-ended, close-ended and multiple choice (Matel and Poskrobko 2016). The first type of questions generates data (amounts) in a continuous form. The amount received can be treated as the respondent's WTP/WTA assuming that respondents' answers to these questions are honest (Brown 2003: 100). They allow for the determination of the upper WTP limit and the lower WTA limit. The second type of questions consists in presenting the respondents with a certain amount that they would be willing to pay or accept for the given scenario (Żylicz 2017). This kind of question is called a dichotomous choice, because only "yes" or "no" answers are expected. It is an indirect way of finding out whether the respondent's WTP/WTA is above or below the amount specified in the question. Usually, the surveys are then carried out in several variants, using questions in the multiple choice format, differing by the amount, which allows for a more accurate estimation of the WTP/WTA distribution and makes the situation similar to that on the market. A variant of the closed-ended question are double bound dichotomous choice questions, in which, depending on the answer to the first question, the next is asked, in which the amount is reduced in the case of a negative answer or increased in the case of a positive answer (Czajkowski 2011: 29–30). The main techniques for obtaining information on WTP/WTA are also the payment card method and iterative bidding games (Haripriya 2003: 5). Payment cards display a range of values that increase from zero at set intervals. The respondent is asked to choose his WTP/WTA from these values. Payment values may differ for different income groups and the respondent is asked to choose the amount of WTP/WTA, depending on his income distribution. An iterative bidding game is similar to an auction. In the first step, the respondent is asked about how much he is willing to pay/accept and the amount given is changed iteratively until the highest

amount the respondent is willing to pay/accept is identified. This method is to facilitate the respondents' thought process, and thus encourage them to carefully consider their preferences (Pearce et al. 2006: 115).

When assessing the value of non-market goods, including free time, is becoming more and more popular the technique of so-called choice modeling or models (CM). It is a family of methodologies based on preference modeling surveys in which goods (or situations) are described in terms of their attributes and the levels they take on. Respondents are presented with various alternative descriptions of a good (or situation), differing in terms of features and their levels, and depending on the CM variant, respondents are asked to rank various alternatives (contingent ranking), rate them on a synthetic, contingent rating or choosing the most preferred (discrete choice) (Pearce et al. 2006: 126; Czajkowski 2011: 32; Hess and Daly 2014). The most popular method in the CM technique is the choice experiment (CE). It differs from CVM in that it is not limited to one WTP/WTA question. Respondents are asked to make the most preferred choice between a set of alternatives known as choice sets. Like in the case of CVM, the respondents are to evaluate the scenario presented to them, e.g., of the possible supply of a good. A good (or a specific situation) is characterized here by a number of attributes (also beyond the existing ones), each of which can be measured at different levels, appropriately quantified in physical or descriptive measures (Czajkowski 2011: 33; Żylicz 2017). Thus, the different alternatives that respondents are to choose from within the set of options are constructed by different levels of these attributes and meet specific estimation requirements for some forms of selection models (Sukanya 2014: 7). This method allows to determine at the same time the value of individual attributes of a valued good, not only its entirety. The answers obtained from the respondents are subjected to statistical analysis and used to infer their preferences in all possible dimensions and levels of the described good. This allows for the determination of the form and parameters of the utility function that is the best for the observed choices (Pearce et al. 2006: 127–128; Czajkowski 2011: 32; Carson 2012; Żylicz 2017). The rationale for using this technique is the observation that it is easier for respondents to choose the preferred alternative instead of directly determining the value of goods in monetary units, which allows to solve some CVM problems (Lloyd-Smith et al. 2018). The advantage of CE is that each respondent provides many statistical observations, not one, like in the classic CVM. Consequently, CE surveys yield statistically better estimates, and their cost is only a fraction of the cost of CVM (Żylicz 2008, 2017; Snowball 2008: 177–178).

5 Discussion and Conclusions

All the methods of economic valuation of non-market goods presented above have their advantages and disadvantages, strengths and weaknesses, which are widely described in the source literature, and some of them have been eliminated through

observing specific rules during their use. However, in the context of the assessment of free time value, some of their weaknesses are worth being emphasized.

In the standard single-site travel cost model, it is assumed that time spent on-site is exogenous. This assumption makes that the WTP for the on-site time is zero, which is unrealistic in possible options for alternative destinations and length of stay (Buason et al. 2020). Proper use of TCM as a proxy for price of free time requires taking into account the fact that each travel takes time, both to get to the destination and to perform various activities there (time spent on-site). With regard to free time, TCM should therefore take into account both types of time, relate their value to visits to recreational places (travel in leisure time, and not travel to paid or unpaid work), with the possibility of using various alternative means of transport and difficulties (facilitation) while traveling and staying at the destination, which may extend (shorten, save) their duration.

On the other hand, the choice of the format of questions asked in CVM and CE is of great importance for the obtained results, and slight differences in the formulation of questions may significantly affect the estimation of the value of free time (Pearce et al. 2006: 108; Czajkowski 2011: 30; Balkiz 2016: 11). When evaluating free time, it should also be taken into account that time is a specific good, well known to each individual, and should not have features of novelty, which could affect the assessment of WTP and WTA (Gajderowicz 2009). The volume of these values and their disparity may be influenced by various factors described in the literature (Pearce et al. 2006: 155–165), which include methods used to determine them and the type of valued good (Tunçela and Hammitt 2014; Brebner and Sonnemans 2018), as well as cognitive errors and principles of heuristic thinking (Matel and Poskrobko 2016).

The research shows that the value of free time also depends on the respondents' gender, age, education and source of income. Also, on the ways of using it (the type of activity undertaken), which are determined equally by personal attitudes and tastes, as well as real life conditions, and its value is also influenced by psychological factors and emotions (boredom, stress) (Kwilecki 2011: 11; DeVoe and Pfeffer 2011; Haller et al. 2013).

So, can the valuation of free time TEV be an easy matter or is it extremely difficult and problematic? Although the TVE concept is constantly being developed and improved, its application significance is somewhat debatable because in practice it is not possible to identify and measure the full spectrum of current and future use value and non-use value. Besides, this concept does not include intrinsic value, which cannot be monetized. The high cost of holistic TEV research and emerging methodological problems also mean that such measurements are rarely undertaken. Typically, such research is limited to the valuation of specific goods, in relation to specific needs of their valuation, assessment of the economic effects of undertaken or planned activities, or the assessment of the impact of non-market goods on the economy. Due to the fact that the evaluation of indirect utility values and the value of options and non-use values is not only methodically difficult, but also subjective, most often, however, direct use values are taken into account in such studies, as their estimation is the easiest.

These comments should especially be related to the valuation of free time, which various TEV components are even difficult to determine, because for people value of this time depends on the possibilities and context of its use for other very diverse activities, and additionally it also has an intrinsic value resulting from its mere existence. However, the scarcity of time, which most people face, is an obvious motivation to consider the value attributed to an activity in research focused on the value of time, including free time.

For this reason, it could be concluded that other approaches to the valuation of free time (opportunity cost or the quality of life) may be more appropriate. But also in this area, the discussion is currently underway (Roberts 2019; Mansfield et al. 2020). Other approaches to the valuation of free time are also suggested, e.g., the method of the laboratory experiment, which eliminates most of the weaknesses of direct and indirect methods of valuing free time is based on the observation that free time is strongly related to the labor market due to its specificity, it directly makes free time traded on the market and gives the actual, not the declarative nature of results (Gajderowicz 2009).

Acknowledgments The project is financed within the framework of program of the Minister of Science and Higher Education under the name "Regional Excellence Initiative" in the year 2019–2022; project number 001/RID/2018/19; the amount of financing PLN 10,684 000.00.

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Part III
Practical Issues: Case Studies

Change as an Element of Decision-Making Behavior: Case Study

Lidia Kłos

Abstract Decision making is one of the many organizational forms influenced by both environmental conditions and human psychological predispositions. An important element influencing the course of the decision-making process is the changeability of the surrounding reality, both in the internal and external dimension of the functioning of the organization (company). Change is an inherent element of the modern world, which includes the functioning of the organization (company) but it also concerns issues affecting human personality and behavior. Operating in a specific, but changing environment, fulfilling its role in given situational conditions, it is a very important element of the decision-making process is the ability to react quickly and to be ready for change.

To present the theoretical, empirical and practical readiness to change, a case study of social workers was used as a determinant of the effectiveness of decision-making behaviors of the members of an organization (company).

The aim of the chapter is to present the preliminary comments and results of the research carried out with the "Questionnaire of Readiness to Change" among social workers and to present them in seven subscales.

Keywords Decision-making process · Change · Readiness to change · Social worker

1 Introduction

In Poland, the profession of a social worker was officially introduced by the Order of the Minister of Education of November 4, 1966, although employees undertaking tasks in this area were already active in the pre-war period, and such studies were conducted at Polish universities from the beginning of the twentieth century. (Journal of Laws of the Ministry of Education 1966, No. 16, item 193).

L. Kłos (✉)
University of Szczecin, Szczecin, Poland
e-mail: lidia.klos@usz.edu.pl

K. Nermend et al. (eds.), *Decision-Making in Management*, Contributions to Management Science, https://doi.org/10.1007/978-3-030-67020-7_10

The profession of a social worker focuses on the social work that an employee performs, both in theoretical and practical dimensions, which refer to the functioning of a given individual, group and social environment. It is an extremely specific job where not only one professional role is performed in professional practice. In reality, the employee carries out specific tasks towards: the client, institution and community, in fact, where he is exposed to constant internal and external changes of the organization (the company). Certainly, the specificity of the profession puts the social worker into a professional group of people who are particularly exposed to mental and physical strain. Changes and unpredictability of the situation and the environment are inscribed in the profession of a social worker. Working in such a difficult reality, a social worker should be prepared to introduce changes among the charges and families that experience problems with which they are unable to cope. In the context of the above, the key question is the readiness to change among social workers themselves and to cope with the changing reality.

The aim of the chapter is to present the preliminary comments and results of the research carried out with the "Questionnaire of Readiness to Change" among social workers and to present them in seven subscales. The survey was conducted at the turn of January and February 2020.

2 Readiness to Change as Part of the Decision-Making Process

The mechanism of shaping organizational behavior is a continuous process of decision-making. The decision, or more broadly speaking, the decision-making process (Koźmiński and Piotrowski 2002: 90) is one of the main organizational activities, as it occurs at all levels, types and phases of existence. The complexity, unpredictability, uncertainty of decision effects, as well as rapid changes may be a source of disturbances in the decision-making process (Mrozowicz 2011: 194–195). Tom Burns and George Stalker proved that the speed and unpredictability of changes in the environment determines the decision-making process (Burns and Stalker 1961).

Nowadays, the pace of changes in the surrounding world is so significant that every company must have developed competences to adapt to external conditions. This means that enterprises must be ready for changes and include such a possibility in the decision-making process of running a business. The necessity is not only to react quickly, but also to be able to anticipate possible changes and anticipate facts that may occur (Wiśniewska-Placheta 2015a: 251). The earlier mentioned process of "anticipating the facts that may occur" is the ability to manage change (Kotter and Caslione 2009: 12). In order to survive and develop, an organization must skillfully and prudently manage change, using the available tools, methods and resources. Unfortunately, it is not a simple challenge, as it requires overcoming many barriers, but nonetheless it is possible. (http://natura2000.efor.pl/pliki/zarzadzanie_zmiana.pdf, accessed: 10/05/2020).

The enterprise should have an appropriate climate of readiness to change and a culture to favor flexible functioning of the organization (the company). It is confirmed that without the company's readiness for changes, proper preparation and an appropriate change management system, the decision-making process will not be able to run properly and without disruptions. This means that the climate of readiness for changes closely related to the change management system is an indispensable element of the decision-making process.

In the process of change management, people are a guarantee of its proper implementation, because their attitude determines the success of the change process (Lubrańska 2001: 3). In constructing these theories, it may be helpful to study the readiness to change, ways of dealing with them and their impact on the functioning of the company (Czechowska-Bieluga 2017: 157).

Analyzing the concept of change in the organization (the company)—it is a transition from the current state to another, clearly different state, and the transition takes place between specific points in time, −which as a result of this- change the properties and the way in which the company operates. At the same time, the transition is expressed in carrying out a permanent correction and modification in the relations between the goals, tasks, apparatus in the time-space dimension and between people (Walas-Trębacz 2009: 20–21; Safin 2013: 23–24).

The above definition shows the scale of the undertaking, which is the implementation of changes in the company's decision-making process. In this perspective, the key is to determine—if the process of organization is ready to change? D. S. Cohen formulates four principles that allow you to evaluate and implement readiness to change. He includes among them:

1. checking the climate/attitude in the process of organization,
2. identification of cultural barriers,
3. adopting a bottom-up (ground-up) position of obtaining information,
4. willingness to resist (Cohen 2008: 268–269).

The table below (Table 1) presents the criteria for assessing and developing the climate of readiness to change. In the context of change management, it is worth mentioning the very concept of readiness to change, which is defined as a subjective perception of the requirements of the environment, accompanied by emotional states, cognitive processes and behavioral determinants, resulting from the interpretation of objective reality (Brzezińska and Paszkowska-Rogacz 2006: 183–184).

The organization's readiness to change should be a determinant of preparation for the change process, as well as a controlling factor at every stage of change management. K. Krzywicka-Szpor states that the organization is ready to change when three conditions are met:

1. there is a leader, serious and effective,
2. people are informed about the planned change, as well as feel personal commitment and motivation,
3. the organization (the company) is characterized by mutual cooperation (Krzywicka-Szpor 2003: 50).

Table 1 The criterion for assessing and developing the climate of readiness to change in the organization (the company) (Cohen 2008: 268–269)

Criterion	Characteristics
Checking the climate in the organization (company)	• Knowledge of the company's climate • Accurate and compelling information presented to leaders who are responsible for the changes • Information sources at various levels of the organization (company) • Providing employees with information in the plural ("on the basis of information obtained from you, we have established that ...")
Indentification of cultural barriers	• Liquidation at the first stage of the change process • The disproportionately high cost of neglecting cultural obstacles
Taking a bottom-up (ground-up) position for obtaining information	• Information from low-rank employees • Communicating information and emotional moods to leaders and bosses
Readiness for resistance	• Inevitable • Preparation of a plan of appropriate response in the event of employee resistance • Including a plan with a thorough presentation and qualification of the sources of resistance • Not underestimating any voice of resistance

Continuing this line of thought, the process of preparing for the implementation of the planned change is also important. According to R. Wendet, the above-mentioned process should consist of:

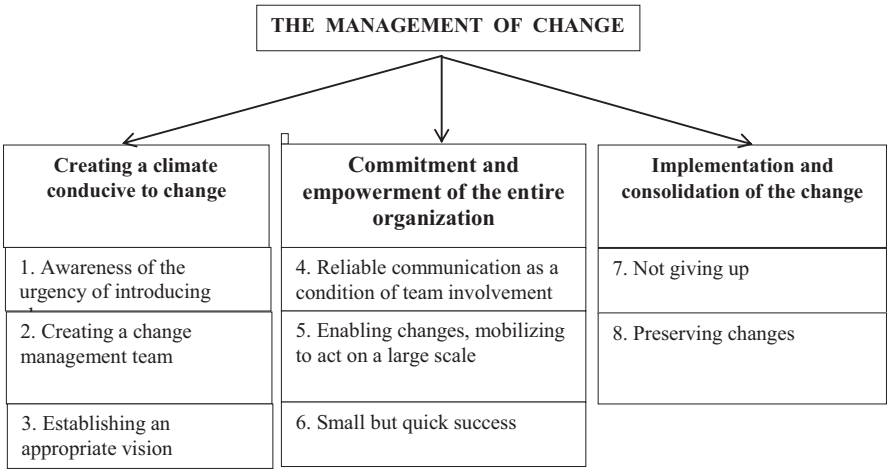
1. analysis and identification of the current situation,
2. creating a change strategy,
3. notification of changes and the time needed for feedback,
4. possible adjustments to the strategy,
5. training for managers/change leader, employees,
6. tools for assessing the effects of this implementation (Wendet 2010: 42–43).

The above-mentioned actions will enable the identification of threats to the change process and for taking further steps for the elimination of obstacles.

Change management is a very complex and comprehensive process that can arise when an organization is ready to change (readiness culture) and has made appropriate preparations. The change management system was presented in the form of a diagram (Table 2). According to J. Kotter's theory, the change management system has eight steps. Their implementation is to ensure a positive result of the decision-making process in the enterprise at every stage of the implementation of changes.

It is worth mentioning that changes may take place on an individual, group or organizational level. What's more—they may apply to the entire organization or its selected areas. As a rule, the scope of changes relates to: techniques and technologies (equipment, information and control systems), processes, structure (relations related to subordination, job design and structure), strategies (strategic goals,

Table 2 The eight-stage process of implementing changes (Wiśniewska-Placheta 2015b: 254)



strategic unit portfolio, functional strategies), culture and people (skills, attitudes, values).

Nowadays, it is paradoxically stated that changeability is the most constant element of the environment, and the organization's policy is focused on constant transformation. That is why employees are so often sought after who show properties that condition openness to new experiences and, at the same time, the need for changes (Kłos and Lesniewska 2018: 98).

3 Questionnaire of Readiness to Change

People often enjoy change and actively seek it. However, they undoubtedly differ in their willingness to accept change. Krygier and Brandt (1996) developed a concept that puts more emphasis on the behavior of individuals oriented towards changes than on behaviors proving resistance to them. The authors made an attempt to define the profile of a person ready to change. According to them, such an individual avoids extreme behaviors that tend to be both passive and overactive. In their model, they distinguished seven indicators of willingness to change. These are: creativity, drive (passion), self-confidence, optimism, risk-taking (boldness), adaptability, tolerance of uncertainty. According to the profile obtained, we can indicate a portrait of a person who is ready to change. This profile is characterized by middle and optimal values of the described features. He can generate ideas and use them effectively, has a positive attitude to the surrounding reality, is prone to perceive opportunities rather than threats, is not afraid of challenges, novelties and uncertainties, has energy resources necessary to act, knows his own talents and skills, and shows great adaptability to a changing environment.

In the study of social workers, the "Readiness to Change Questionnaire" was used, which is a Polish translation of the American method, whose authors are Krygier and Brandt (1996). Brzezińska and Paszkowska-Rogacz (2000: 51–53). The questionnaire consists of 35 items, each subscale includes 5 items. The respondent, answering individual items of the test on a 6-point scale, determines the truth of the statements describing beliefs, attitudes and behaviors concerning various life situations. The results obtained by the subjects are calculated separately for each subscale according to the key. In the original method, the optimal level of readiness to change is demonstrated by the results in the range of 22–26 points. According to the author's version, the seven dimensions of readiness to change (subscales) are: ingenuity, drive, self-confidence, optimism, risk-taking, adaptability and tolerance of uncertainty. These characteristics should be understood as follows:

Ingenuity is interpreted as the ability to use any opportunity to pursue one's own goals, and also as the ability to do "something out of nothing". Thus, inventive people are characterized by the ability to reach the right sources and resources that enable the implementation of their plans. Moreover, these people believe that every problem is possible to solve, and that any difficulties are both a value in themselves and a challenge at the same time. Moreover, these people are able to perceive various tactics of action, and they approach stereotypical issues in a creative way (Paszkowska-Rogacz and Tarkowska 2004: 209–215).

Optimism correlates with the readiness to undertake changes, which means that people with a high intensity of this trait are characterized by a positive, and sometimes enthusiastic attitude towards new things. It is important that people do not focus on the difficulties, but see the various possibilities. At the same time, they believe that the passage of time is favorable for them and they interpret reality in the same way.

Another personality trait is related to the risks taken. It turns out that risk takers are people with a high level of boldness. They perceive life as an adventure. They are characterized by constant movement and anxiety, they are not supporters of security and stagnation. They prefer challenges, and routine and repetitive activities bore them. As a rule, they are initiators of changes, they work effectively in an activating environment.

Passion is a quality that is a kind of potential that strengthens all other qualities. It is confirmed that people with a high intensity of this trait are less likely to fatigue, and a very high score of this trait may be associated with them being left in unjustified stubbornness which may contribute to rapid burnout. People with passion perform difficult tasks, are full of energy, and additionally—they feel enthusiasm more than fear.

Consecutively, adaptive ability, which is analyzed using the "Readiness to Change Questionnaire", includes 2 components—flexibility (enabling easy adaptation to changing environmental requirements) and resilience (ensuring that they do not break down when encountering failures, but learn thanks to their mistakes). It is important that flexibility allows the individual to avoid disappointment and frustration and, if necessary, change plans (taking into account previously prepared options). It is confirmed that flexible people set realistic goals for themselves.

In turn, resilience—is a feature of people who do not attach too much importance to their own status and functions, who rather live in the present and the future (not paying attention to the past).

Self-confidence, which is also the subject of the analysis of the above-mentioned questionnaire, characterizes people who have confidence in their own abilities and possibilities. A high score in this trait means that such people are individuals with strong self-esteem and convinced that they are in control of their own lives. It is noted that if it is impossible to change the current reality, such people strive to use their situational options to the maximum. At the same time, they believe that without failures you cannot achieve mastery, which means that they learn from mistakes.

The tolerance of uncertainty is inherent in people who believe that nothing is for sure. These people are convinced that they can be surprised by any plan they make or encounter. They show patience and are not rash, because they do not expect quick and simple solutions (Paszkowska-Rogacz and Tarkowska 2004: 209–215).

A social worker is prepared to professionally introduce changes in families experiencing problems that they cannot cope with on their own, but is he ready to change himself? Due to the above, research on the readiness to change among social workers was conducted.

4 Test Results and Assessment of Readiness to Change Among Social Workers

The initial stage of the research process was to conduct research and analyze the collected empirical material in order to illustrate the internal structure of readiness to change.

The study included 96 social workers from the West Pomeranian district (Poland). The survey was conducted in January and February 2020. The demographic picture of the respondents does not differ from the general data on this socio-professional category. Only 5% of the researched individuals were men. The statistical dominance of women in the profession of the social worker is still very visible. Most of the respondents, as much as 50%, were between 45 and 50 years old. The second group were younger social workers between 31 and 40 years of age. This group comprised 40% of the respondents. The smallest group were the youngest social workers under 30 years of age—10% of the respondents. Work experience is closely related to age. As the conducted research shows, this professional group is aging. This may have consequences in terms of openness and willingness to change. Detailed results of the research on the structure of readiness to change among social workers are presented in Table 3.

The following is an assessment of the individual subscales of the questionnaire among the surveyed social workers—these indicators were as follows:

Table 3 Structure of readiness to change among social workers (own study based on research)

Number	Dimensional readiness to change Percentage scale (%)	Low level	Optimal level	High level
1.	Drive (passion)	43	35	22
2.	Optimism	64	36	–
3.	Taking risks (boldness)	78	22	–
4.	Ingenuity	43	57	–
5.	Confidence	36	42	22
6.	Adaptability	71	29	–
7.	Tolerance to uncertainty	86	14	–

1. Drive (passion)
   Passion, being a kind of energy that strengthens all other qualities, causes that "Passionates" are less likely to become weary and tired. On the threshold of difficult tasks, they do not feel fear, but are rather full of energy and enthusiasm. In the study, only 35% of the respondents obtained the optimal result in this indicator. 43% of the social workers did not show this drive—passion. On the other hand, 22% of the respondents obtained a high (above average) result. The obtained result raises concerns, because an important feature of a modern employee is having passion and being positively infected with passion. Passion is an important feature of people working in the profession of a social worker, because they come into contact with different people on a daily basis, who are often deprived of their self-love and goals in life. People full of professional energy, commitment and interests can significantly affect the quality of life of their environment, positively infect other with their interests, opening new horizons and instilling new ideas.
2. Optimism
   The trait of optimism is highly correlated with the willingness to undertake changes. Optimists have a positive, and sometimes even enthusiastic attitude towards any novelty. Contrary to pessimists, who are focused on difficulties and obstacles, optimists see various possibilities and opportunities around them. They interpret reality positively and believe that time is working to their advantage. In the sample of social workers, the optimism index ranged between 17 and 20 points. This result is low, as only 36% of the respondents achieved the optimal result. 64% of the respondents obtained a low result and it was a result below 13 points. There was no high score in this category. This means that the optimism index among this group of social workers was low and is not conducive to readiness to change.
3. Taking risks (boldness)
   People who are not afraid to take risks treat life as a great adventure. They love challenges. They are characterized by constant movement and anxiety, they hate the feeling of security and stagnation. They are bored with routine and repetitive activities. Usually they are creators of change and undertake innovative activities. They work effectively in an environment full of "storms and turbulences".

This feature allows for many positive changes, especially in changing, dynamic conditions. Social workers showed no willingness to take risks. Only 22% of the respondents obtained the optimal result in this respect, which proves a very low propensity to take risks. The vast majority of the respondents achieved a result in the range of 8–16 points, which constitutes 78% of all indications.

4. Ingenuity
   Inventive people can use any situation for their own purposes and make "something out of nothing". They know how to reach the right sources and resources to make their plans come true. They see various ways of operating and approach, even towards stereotypical issues in a creative way. They know that every problem can be solved, and that the difficulties inherent in a stereotypical situation constitutes a challenge and a value in itself. The survey showed that more than half of the social workers were inventive (57%). The respondents obtained an optimal result of 22–26 points in this respect. These results apply to the majority of employees, regardless of their age and length of service. It is disturbing that nearly 43% of the respondents did not show any creativity in their actions.
5. Self-confidence
   While optimists positively interpret external reality, confident people have confidence in their own abilities and possibilities. A high score on this scale is typical for people with strong self-esteem. They are convinced that they are in control of their lives. If, despite their willingness, they cannot change the reality around them, they try to make the most of it. They are not scared by the possibility of failure, and single failures do not undermine their self-confidence. They learn from their mistakes, believing that there is no mastery without failures. The average result of the group of respondents was slightly lower than the optimal result, amounting to 21 points. Self-esteem was demonstrated in 42% of the social workers achieving an optimal result. This means that nearly half of the employees were self-confident. Subsequently, 36% of the surveyed employees stated that they did not have self-esteem and resistance to failure. On the other hand, 22% of all the respondents obtained a higher than optimal result, which would indicate presumption (conceit) or a tendency to reject other people's opinions about themselves.
6. Adaptability
   This ability consists of two components: flexibility and resistance. Thanks to flexibility, it is possible for a person to easily adapt to the changing requirements of the environment. This trait causes the person to avoid his own disappointment and frustration. Flexible people set goals for themselves, but do not invest in their implementation excessively. If necessary, they quickly change plans having various options prepared in advance. Resilience is a feature thanks to which people do not break down when encountering failures, and past mistakes have educational value for them. They live for today and for the future rather than the past. They do not attach too much importance to their own status and functions. The average result for the studied group was 18 points. Only 29% of the respondents obtained an optimal result. This may translate into difficulties in adapting to the changing social reality (adaptation difficulties).

7. Tolerance to Uncertainty
   For those with this trait, the only sure thing is that nothing is certain in today's world. They accept this state of things, knowing that in the implementation of each plan, new and surprising elements may appear. Since they do not expect quick solutions or simple answers, they are patient and do not make rash judgments. In the studied group of social workers, the average value of this indicator was only 15 points. 86% of the respondents had no tolerance for uncertainty. 14% of social workers were within the optimal values, i.e., they had tolerance to uncertainty.
   As the analyzed indicators show, not all surveyed social workers were ready to change. This may be due to their age, seniority at their position at work or traditional approach to the profession. These results still require further analysis. Young workers were equipped with different skills and their openness to change was greater. Older employees who struggle with numerous social problems in their careers may already be tired or adopt a passive attitude.

5 Conclusions

Social work is related to the fulfillment of a social mission and requires special responsibility for other people. A social worker helps people who, for various reasons, are unable to overcome the problems and difficulties of everyday life on their own. The willingness and obligation to help in practicing this profession is superior and unconditional. At the same time, it requires the social worker to fully commit to the activities carried out by him in order to achieve the best results.

In the era of political, social and economic changes, a social worker is forced to constantly improve his technique of work, and thus adapt the methods of social work to the current life situation of his clients. The social welfare system must quickly evolve to cope with changes taking place in the social reality.

The research conducted among social workers confirms that few employees are ready to change. Among the positive features, creativity and self-confidence dominate. Unfortunately, one of the weaker features is optimism, which in the case of employees, is a key element of functioning. It probably results from the age range of the respondents and the length of service. Older employees, who are worried about social problems on a daily basis, are usually tired and this makes them adopt a passive attitude. At the same time, risk taking, adaptability and tolerance to uncertainty were assessed at a low level.

A question should then be asked: how to best prepare a social worker for new, necessary and professional roles, necessary both in social work and in performing many important tasks related to managing social welfare institutions, as well as resulting from the participation in the network of entities solving social problems in the local community? The idea of the profession of a social worker and social work is multifaceted action for the benefit of people in difficult family, financial, professional, health or housing situations. It seems important for the social worker to be ready to change and have the knowledge and skills to deal with the dynamically developing social reality.

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Market, Workplace, Society or Environment? Consumer Perception of Engagement in Different Facets of CSR

Aleksandra Furman and Dominika Maison

Abstract In the time of business' growing interest in the Corporate Social Responsibility (CSR), understanding consumers' reactions to CSR is of particular importance: whether consumers expect the companies to engage in CSR, how they perceive different CSR activities and how it impacts consumer decisions. In order to answer these questions quantitative online survey on representative Polish sample was conducted ($n = 1055$). The study consisted of two waves. In the first wave of the study opinions and attitudes towards CSR engagement were measured. The results showed that Polish consumers expect the firms' engagement, though they rarely expect CSR to be a whole philosophy of conducting business. Consumers expect also most engagement in marketplace and workplace facets. In the second wave (experimental study) respondents were presented a fictitious press note about new energy provider entering the Polish market, including information about the company's engagement in one of four CSR facets: marketplace, workplace, environment and society. The results showed that only the environmental engagement significantly increased purchase intentions. We conclude that it is possible that consumers demand engagement on more basic level (marketplace, workplace) as something obligatory, therefore in order to enhance the purchase intentions, companies must show some additional engagement, for example environment- or society-related.

Keywords CSR strategy · Consumer engagement · Consumer decisions · CSR facets

A. Furman (✉) · D. Maison
Wydział Psychologii, Uniwersytet Warszawski, Warszawa, Poland
e-mail: aleksandra.furman@psych.uw.edu.pl

K. Nermend et al. (eds.), *Decision-Making in Management*, Contributions to Management Science, https://doi.org/10.1007/978-3-030-67020-7_11

1 Introduction

As Corporate Social Responsibility (CSR) becomes a common concept, employed throughout all business sectors, managers face numerous key decisions: how to design CSR strategy of the company, and to what areas it should be directed. Over time, understanding of CSR turned from voluntarily taken actions, to the whole philosophy of conducting business affecting all its operations (i.e., compare European Commission definitions 2001, 2011). Such understood CSR strategy should cover different dimensions: marketplace, workplace, environment and society-related responsibilities. However, some theorists assume that not all CSR activities are equally important in terms of building effective strategy—some responsibilities, namely economic and legal ones, are prior to others (Carroll 1991).

One of key conditions for CSR actions effectiveness is a positive response of the consumers to companies' communication. Therefore, managers should not only pay attention to economic and managerial theoretical assumptions, but also study and understand the consumer perspective. In our study, we posed the questions of consumer perception of the issues raised above. Namely, we wanted to know whether consumers believe that CSR is necessary to be employed and to what extent? Do they perceive some CSR facets as more important than others? And how does it affect their actual reactions to the communication of CSR activities? Understanding this is very important for managerial decisions: which area of CSR involvement to choose in order to enhance company image and influence consumer choice.

2 Literature Review

2.1 Dimensions of CSR

As the concept of CSR evolved, across the literature there are many different ways in which it is viewed and defined (Wang and Juslin 2011). However, most recent definitions underline similar aspects of the CSR concept. New definition by European Commission states that the CSR should be understood as "the responsibility of enterprises for their impacts on society" and that "to fully meet their corporate social responsibility, enterprises should have in place a process to integrate social, environmental, ethical, human rights and consumer concerns into their business operations and core strategy" (European Commission 2011, p. 7). This definition underlines that CSR should be understood as a deep strategical politics underlying all company's operations. It also pays attention to different areas that CSR contains: social, environmental, human rights, consumer concerns.

Many other definitions underline multidimensionality of CSR concept as well. Sarkar and Searcy (2016), having analyzed 110 definitions of CSR, come

to conclusion that CSR is a concept embracing dimensions such as economic, ethical, social responsibilities, as well as stakeholders, including employees and their families. In a new definition formulated based on their analysis they underline that CSR is a politics that goes beyond actions demanded by law and voluntarily undertaking other activities in pursuit of being more ethical.

Some scholars argue that not all dimensions of CSR have equal importance. Carroll (1991) conceptualized CSR as a pyramid, where some areas are more basic than others. According to this scholar, CSR consists of four dimensions, listing from the most basic: economic, legal, ethical and philanthropic responsibilities. Economic responsibilities mean economical reliability: being profitable, legal—obeying the law, ethical—obeying social and ethical norms, philanthropic—enhancing the good of communities within which the business operates by involving in charitable actions and sponsorship. Though a company that engages in CSR should fulfil all these responsibilities, engagement in any higher area is purposeful only when the more basic ones are addressed. For example, a firm cannot reliably fulfil ethical responsibilities, if some of its operations are illegal, or building friendly workplace and paying well will not be any good if the business goes bankrupt, or a philanthropy will not make up for the low quality of products or performing services that are socially harmful.

In business practice, managers often construct and report strategies based on conceptualization involving the four so called facets of CSR: marketplace, workplace, environment and community/society (Whooley 2004). Marketplace is understood as core business activity: its economic and social benefits and costs. Workplace means conducting responsible employment politics, environment—minimizing negative effects of business practices and undertaking actions benefiting the environment, society—being a good citizen, supporting local communities or societies within which the business operates.

The four CSR facets might be linked with the dimensions indicated by Carroll (1991). Marketplace is in fact strictly related to economic responsibilities. Workplace and environment facets, depending on specific activities undertaken—whether they are demanded by law or voluntarily undertaken in order to conduct ethical business, might be related to legal or ethical responsibilities. Actions dedicated to community seem to fit most philanthropic responsibilities. However, those two approaches differ in the relation between different aspects of CSR. The four facets of CSR: marketplace, workplace, environment, society, are usually presented as equally important (i.e., Jones et al. 2005), whereas dimensions described by Carroll (1991) are assumed to be in hierarchical relation, though contemporarily also other possible relations as well as their implications are discussed (Geva 2008).

The question that remains open is how these marketing theories refer to what consumers think and how they react to CSR actions—do they expect firms to act responsibly, and how do they respond to actions connected with different facets of CSR.

2.2 Consumers' Responses to CSR

There is a broad scientific evidence showing that in general, employing CSR politics evokes positive response on the side of consumers. CSR affects positively perception of the firm (Hur et al. 2014), its products (Chernev and Blair 2015; Hartmann and Apaolaza-Ibáñez 2009; Peloza et al. 2015), loyalty (Klein and Dawar 2004), and purchase intentions (Bhattacharya and Sen 2012). What is more, as Du et al. (2007) analyses show, such results are most likely to occur when the company integrates CSR policies with its business strategy. Also, metaanalyses show that there is a link between implementing CSR practices and economic performance of the company (Barcos et al. 2013; Crifo et al. 2016). However, there are also some results indicating that CSR politics not always evokes expected response on the side on consumers—for example, size of the company has stronger effect on reputation than CSR (Hutton et al. 2001). In light of such inconsistent results it seems crucially important to understand what moderates relation between CSR politics and consumers' reactions. Some researchers indicate that effects of CSR on economic performance are different depending on CSR dimension: for example, that the market seems to punish companies that are not fulfilling their legal and ethical requirements concerning specifically areas of diversity and environment. Also conducting responsible workplace politics seemed to have positive long-term impact on economic performance (Bird et al. 2007). Such results show indirectly that consumers are more susceptible to some CSR actions than others.

More direct evidence that consumers might perceive some responsibilities as more important than others comes from studies such as one by Sen and Bhattacharya (2001), who showed that information about CSR workplace-related engagement (dealing with ethical issues) could even decrease purchase intention, when the corporate ability (economical skill of the company) was low and consumers did not particularly support CSR. Similarly, Luo and Bhattacharya (2006) analyses showed that CSR enhanced market value of the company only when its economic performance (innovativeness, product quality) was high. Economic performance of the firm seems to have more impact on product evaluation than prosocial engagement especially in case of highly engaging products (Huang 2015).

Many studies explored more psychological side of the process; what differentiates consumers reactions to different CSR practices. One important concept is so called brand-cause fit. In general, CSR actions that fit what the firm produces or how it is perceived seem to evoke better reaction on the side of the consumers (Becker-Olsen et al. 2006; Ellen et al. 2006; Marín et al. 2016; Oberseder et al. 2011). However, as some other scholars point out, high fit may sometimes cause that company's benefits from engaging in action are too obvious, what contributes to higher level of scepticism and diminished or even negative reactions on the side of consumers (Forehand and Grier 2004). This was especially the case of companies with bad reputations—for example, tobacco company will not benefit from fighting the lung cancer (Yoon et al. 2006). Such results confirm as well theoretical assumptions

that engagement in philanthropic actions may not be reliable when there are ruptures in fulfilling ethical dimension.

To conclude, to-date research gives some clues to managers considering possible effects of their CSR strategy. First, they should make sure the firm is perceived as good quality and stable in economic terms. Then, the causes they choose should fit the brand's business area and image, though it is also important that company is perceived as intrinsically motivated and its benefits from undertaken actions should not be obvious. However, still little is known about how consumers react to CSR campaigns conducted in different CSR facets. Do consumers perceive the marketplace, workplace, environment and society facets are equally important? And how does it translate to consumer decisions? Addressing these questions seems crucial in order to help managers build effective CSR strategies.

2.3 Goal of the Study

The goal of the present study was to explore reactions of Polish consumers to CSR engagement of the company, both in terms of how the general idea of CSR is perceived and what reactions are evoked by engagement in specific CSR facets. In order to do that, we performed a two-wave study, using both direct questions about consumers' opinions and experimental methodology. We expected that consumers would believe that the companies should engage primarily in marketplace and workplace facets, than in environment and society facet. However, we also expected that if our predictions are right and some CSR facets are viewed as more basic than others, it is possible that engagement in facets of basic level will not be perceived as something that builds competitive position of the company. We assumed that communicating company's engagement in facets that would be perceived as less basic and not mandatory would be more effective in terms of enhancing purchase intentions. Namely, we expected that society-related actions should enhance purchase intentions most, and marketplace-related actions should enhance purchase intentions least.

3 Method

3.1 Participants and Procedure

We conducted an on-line survey with participation of a random quota sample of Polish consumers. Participants were randomly chosen from a large database of an on-line research panel and invited to take part in the study. The demographic characteristics were controlled so that the sample structure corresponded to the Polish population structure (quota selection). The sample was representative for Poles

aged 18–55 with respect to sex, age and the size of the place of residence. A total number of 1055 participants completed both waves of the survey: 514 women, 541 men, aged 18–55 (M = 33.39, SD = 10.52). Majority of the participants completed secondary education (n = 558). Monthly household income ranged from 99 to 60,000 PLN (22 to 13,500 EUR; M = 3428.08, SD = 3066.38).

In order to avoid influence of first part of the study (measure of opinions and attitudes towards CSR) on second part of the study (experimental), those two parts were conducted separately within a fewdays distance. In the first wave, we asked about general expectations of CSR engagement, as well as expected engagement in different CSR facets (marketplace, workplace, environment, society), among other variables.[1] In the second wave, we carried out an experimental study.

3.2 Measures

General expectations of CSR engagement were measured using the question "Below different goals of enterprises' existence are listed. Please choose one that is closest to what you think about this matter". Participants indicated one of the following statements: (1) The main goal of companies is to make money—I do not expect any other action from them; (2) Companies are primarily there to make money, but should also take some action on the environment, communities, etc.; (3) Companies should actively support various activities for the benefit of society and the environment, e.g., allocating their money and time for those purposes; (4) Companies should not only support, but also initiate various activities for the benefit of society and the environment, and actively seek solutions to solve various problems.

Expected engagement in different CSR facets was measured using the question "In spite of the basic activity, which is the production of goods and services, companies can engage in various additional activities. Please indicate, in which of the following activities—in your opinion—companies should get involved most often?" The activities listed were related to four CSR factes: (a) marketplace "Activities focused on building relationships with consumers, customers, suppliers and business partners (e.g., taking care of ethical relationships with suppliers, good quality products at the right price)"; (b) workplace "Activities related to the creation of an appropriate workplace (e.g., responsible treatment of employees, remuneration appropriate for work, development programs for employees, additional benefits, open communication)" (c), environment "Initiatives and actions aimed at reducing the negative impact on the natural environment (e.g., saving water and energy resources, products in recyclable packaging)" (d), society "Initiatives and social activities that support solving problems important for society (e.g., undertaking

[1] The reported results are a part of larger dataset including other measures of attitudes toward CSR, and personality traits. This dataset was also used by Furman et al. (2020).

actions for the society in which a given company operates)". Participants were asked to range activities from the ones in which companies should engage to the greatest extent (1) to the ones companies should involve the least (4).

Impact on purchase decisions of each CSR facet was measured using the question "Think about how you choose different products and services. Please indicate to what extent are the following issues important to you". Participants chose answer on a scale ranging from 1—definitely unimportant to 5—definitely important. The scale consisted of 8 items, with two items representing each of the CSR facets: marketplace, workplace, environment, and society. For marketplace, the items were: "The company sets prices fairly (good products/services at a good price)", and "The company cares for the customer (e.g., through appropriate customer service, consideration of complaints)", $\alpha = 0.69$, $M = 4.21$, $SD = 0.68$. For workplace, items were: "The company cares about its employees (responsible employment policy and employee development)", and "The company cares about good and safe working conditions in its workplaces", $\alpha = 0.84$, $M = 3.64$, $SD = 0.91$. For environment, items were: "Eco-friendly product packaging (e.g., biodegradable, recyclable)", and "The company produces environment-friendly products", $\alpha = 0.80$, $M = 3.68$, $SD = 0.90$. For society, items were: "The company undertakes social activities (donations to social organizations, employee volunteering)", "The company is involved in solving important social problems", $\alpha = 0.79$, $M = 3.22$, $SD = 0.88$.

3.3 Experimental Study Design

In order to measure purchase intentions in response to engagement in different CSR facets, we carried out experimental study with one control and four experimental conditions. We used fictional press note on non-existing energy company "Energon". The note contained some basic information about the company, its manager and offer. In the control condition (no engagement in CSR) the note additionally informed about the location of firm's facilities. In the four experimental conditions the information about companies' engagement in one of the CSR facets was added (marketplace, workplace, environment or society-related CSR activities). Participants were randomly assigned to one of the five conditions and asked to carefully read the press note. Then they declared their purchase intentions.

Purchase intentions in reaction to company's CSR engagement were measured by asking participants, to what extent they would be willing to choose Energon services, if the cost would be similar to other same quality offers. The participants indicated their answers on a scale ranging from 1—definitely would not choose this offer to 4—definitely would choose this offer; $M = 2.13$, $SD = 0.70$.

4 Results

4.1 Opinions and Attitudes Toward CSR and Different CSR Facets

As far as general expectations of CSR engagement are concerned, the vast majority (80.6%) of participants declared they expect that the firms would engage in some activities apart from making money (Fig. 1). However, only 40% expected from companies more active involvement in actions which could benefit the society. This means that the majority (60%) of participants did not expect any CSR engagement or expected rather incidental, voluntary actions than whole CSR strategy integrated with all business operations.

In case of expected engagement in different CSR facets, most engagement was expected in the workplace (see Fig. 2): 40.8% indicated it as an area to be taken care of in the first place. Considerable engagement was expected in marketplace (19.8%) and environment facets (22.8%). Least engagement was expected in society facet, with only 16.6% putting it in the first place.

As for the impact on purchase decisions of each CSR facet (Fig. 3), most attention was paid to the marketplace activities, and least to ones connected with society. A set of paired sample t-test analyses showed that the differences between all facets were statistically significant, except the difference between workplace and environment-related activities (Table 1).

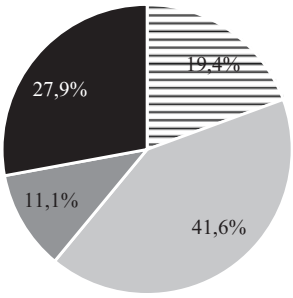

Fig. 1 General expectations of CSR engagement

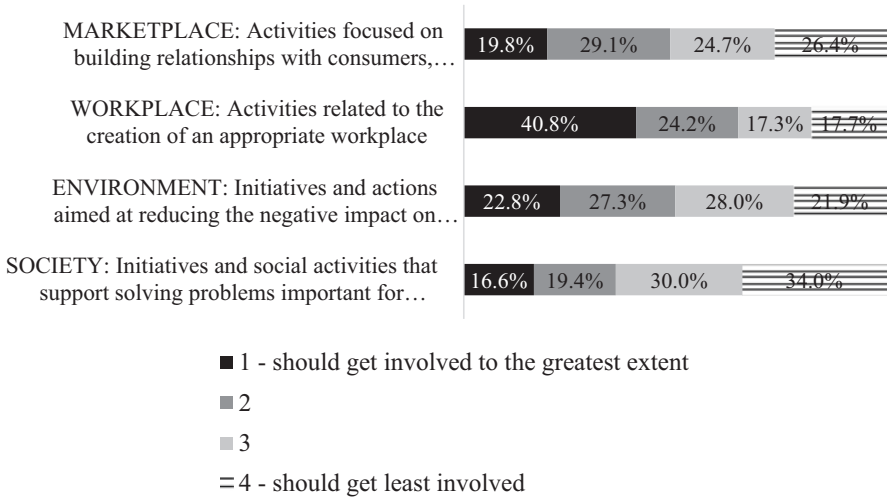

Fig. 2 Expected engagement in different CSR facets

Fig. 3 Impact on purchase decisions of each CSR facet—means

Table 1 Impact on purchase decisions of each CSR facet—results of paired samples t-test

	M	*SD*	*t* (1054)	*p*
Market—Employment	0.57	0.87	21.16	<.001
Market—Environment	0.53	0.88	19.70	<.001
Market—Society	0.99	0.96	33.47	<.001
Employment—Environment	−0.03	0.79	−1.42	.156
Employment—Society	0.41	0.74	18.24	<.001
Environment—Society	0.45	0.74	19.82	<.001

M mean, *SD* standard deviation

4.2 *Influence of Different CSR Activities on Consumer Decision (Purchase Intentions)—Experimental Study*

In order to analyze the experimental results, we conducted one-way ANOVA analysis, with purchase intentions as the dependent variable and experimental conditions as factor. Results revealed that in all experimental conditions (including CSR message) purchase intention was higher than in control condition (without CSR message), and that the differences between conditions were statistically significant, $F(4,1050) = 5.64$; $p < 0.001$. However, as Tamhane's post-hoc tests revealed, only engagement in environment-related CSR activities significantly enhanced purchase intentions compared to control condition (no engagement). Significant differences were also found between engagement in workplace-related and environment-related activities, with higher purchase intentions when the company engaged in environment-related activities. Differences between marketplace-, society- and environment-related activities were not significant (Fig. 4).

5 Conclusions

We may draw several important conclusions from our results that could have importance for managerial decisions concerning CSR policies.

Firstly, we may see that Polish consumers seem not to expect CSR engagement from companies in the extent in which companies expect it from themselves. More than half of Poles aged 18–55 believes that companies either do not need to engage in anything more than making money or may do so, but making money should be still their only priority. Such attitude may have great impact on purchase deci-

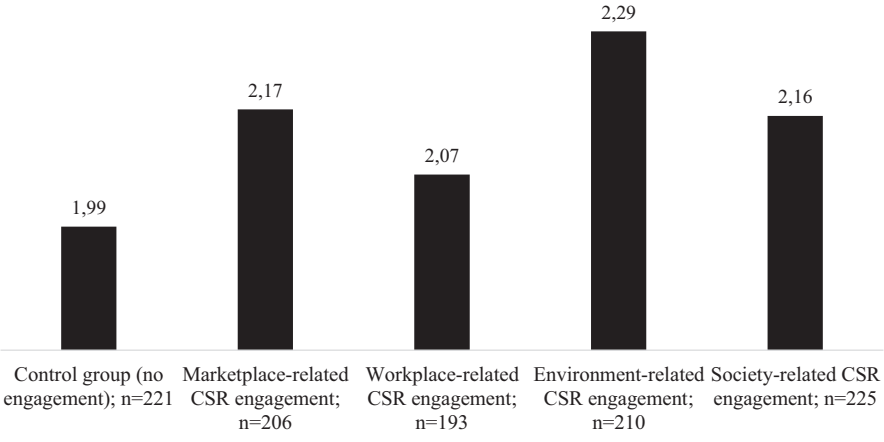

Fig. 4 Purchase intentions in case of engagement in different CSR facets: marketplace-, workplace-, environment- or society-related (means)

sions—consumers who do not know what CSR is or do not expect it, will not take it into account when making purchase decisions. It is possible that Polish consumers are a group that still need more education and knowledge on the issue of CSR, as results of some other studies performed in Western societies—e.g., in Greece (Vassilikopoulou et al. 2005), show higher percentages of consumers with positive attitudes towards CSR. However, there are also studies corresponding with our results—for example only 42% of Australian consumers engage in ethical consumption, while 34% have negative attitude towards it (Burke et al. 2014). It is something that should be taken into account in managerial decisions on CSR policies. It is clear that employing CSR strategy is an ethical obligation of the business. However, as some consumers seem unaware of what CSR is and to what extent it is present in business world, perhaps companies should make information and education one of their priorities.

Another important point are the results referring to CSR facets. In general, our results are in line with theoretical assumptions. Both in terms of expectations of engagement in different facets, as well as of impact of engagement in different CSR facets on purchase decisions, we may see that some facets are perceived as more basic than others. As predicted, at the level of explicit opinions and declarations, marketplace and workplace activities seem to be most expected by consumers. Marketplace activities, connected with most basic level of company's responsibilities according to Carroll's (1991) theory, were the factor quite strongly expected from companies and reported by consumers to have highest impact on their everyday purchase decisions. Workplace-related engagement was most strongly expected. Workplace- and environment-related activities affected purchase decision less than marketplace ones, but more than society-related ones.

The shift between marketplace and workplace (declarative bigger importance of workplace-related activities, but stronger impact of marketplace-related activities on purchase decisions) may be connected with attempt to preserve positive self-image—putting other's interest (employees) over one's interest (as a consumer) in a more direct question—what is most important. It is worth underlying that similar shifts has already been observed in other studies—e.g., in study by Planken et al. (2013) both Dutch and Indian participants declared that realizing legal, ethical and philanthropic responsibilities by the companies is more important to them than realizing economical ones. For both ours and just cited study, it is possible that participants did not fully understand what issues are connected with economical or marketplace facet. In a more specific question of what impacts purchase decisions, more examples were given and here the marketplace-related actions were indicated as more important. In spite of this slight inconsistency, the results so far show clear pattern—with marketplace (connected with economic responsibilities) as facet of most importance for consumers, workplace and environment as second important and society as least important. These results are in line with previous studies showing that consumers react positively to CSR only when the economic ability of company, i.e., product quality, is perceived as fine (Luo and Bhattacharya 2006). It seems that when it comes to purchase decisions, consumers think first about most basic firms' activity—how it performs as a producer or service provider, or as an

employer. These are also the areas that most likely affect themselves in person—as consumers, and as possible employees or family members of employees.

However, also along with our predictions, things look different from the perspective of experimental results. Here, not the marketplace, and not the workplace, but only the environment-related actions enhanced purchase intentions compared to no-engagement condition. This result is in line with our initial assumptions that though responsible conduct in terms of marketplace and workplace is something that the consumers expect from the companies, it is not a value enough to be effectively used in communication in order to enhance purchase intentions. Consumers expect the companies to conduct fair price politics, be consumer-friendly or be a good employer, but treat it as a kind of standard that all companies should comply. Only perception of specific companies as exceptionally good or bad in fulfilling these standards may affect the purchase decisions, but otherwise such information will not draw consumers' attention.

What was a bit surprising, only environment-, but not society-related actions enhanced purchase intentions. One possible explanation is that in case of energy company used in the experimental scenario, environment-friendly actions fitted the brand, which is in line with numerous results showing that CSR is most beneficial when the cause-brand fit is high (i.e., Becker-Olsen et al. 2006). Such result also shows that in theory, both marketers and consumers might see things in one way (for example that marketplace and workplace are crucial CSR facets, or that communicating society- and environment-related actions may enhance purchase intentions), but in market reality many other factors, such as brand-action fit, come to play part.

So, the conclusion might be that marketplace and workplace conducts serve as something basic and obligatory. Any rupture in these facets endangers other CSR actions of the companies to be unreliable and ineffective. But, in order to increase sales, it is the less basic actions—those concerning environment or society, respectively to what most fits the brand—are something that should be communicated. Referring once again to Carroll's (1991) terminology, complying economic and legal responsibilities serves as foundation, but only complying ethical and philanthropic responsibilities serves as a décor—something to distinguish the company and to be remembered.

At the end, some limitations of the present research should be pointed out. Firstly, we must underline that our research was conducted in one country—Poland, which limits the possibility to generalize the results, as it is a post-communist country, which has still its effects on both state economics, as well as on attitudes and behaviors of the consumers. It is possible that the results would be different in western countries, with longer free market traditions. Secondly, the experimental results need replication, using other type of company and other examples of actions related to different CSR facets.

Acknowledgments The preparation of this manuscript was financed from the funds of the Polish National Science Centre (No. 2017/25/B/HS4/00275).

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RESPECT Index on the Stock Exchange, Building an Investment Portfolio

Magda Ankiewicz

Abstract The aim of the chapter is to verify whether portfolio investments in companies declaring the use of CSR can be effective. The chapter aims to indicate whether the use of information on the use of CSR by companies may be effective in making long-term investment decisions. For this purpose, a portfolio of securities for companies included in the RESPECT index was built, and its effectiveness was presented in comparison to the portfolio built using the classic approach. The conducted study will answer the question of whether portfolio investments in companies declaring the use of CSR can be beneficial and whether focusing only on companies of this type can be an alternative to building a securities portfolio. It is important for the horizontal diversification of risk. The analysis used data on the share prices of companies listed on the WSE in 2019–2020. The analysis was carried out for companies included in the WIG20 and RESPECT Index.

Keywords Portfolio analysis · Corporate social responsibility · Risk diversification · Investment decisions

1 Introduction

Making investment decisions on the stock exchange is complex. While focusing on long-term investing, the portfolio theory and risk diversification issues are of particular importance in making investment decisions. When building an investment portfolio, investors pay attention to many factors of a quantitative nature (e.g., the rate of return on shares, investment risk, level of liquidity) and qualitative (e.g., the sector the company comes from, market position). These factors are to support the selection and selection of companies in the context of building a securities portfolio. Investors focus on choosing the most attractive companies for investment and diversifying investment risk. In the literature on the subject, the issue of diversification and risk management is well-established (e.g., Łuniewska 2004; Tarczyńska-

M. Ankiewicz (✉)
Faculty of Economics and Management, University of Szczecin, Szczecin, Poland

K. Nermend et al. (eds.), *Decision-Making in Management*, Contributions to Management Science, https://doi.org/10.1007/978-3-030-67020-7_12

Łuniewska 2010; Tarczyński 2004). In this respect, a classic approach can be used, the precursors of which are Markowitz and Sharpe or non-classical approaches, for example, using fundamental analysis in the portfolio construction process (Tarczyński and Łuniewska 2005; Tarczyński 2006, 2017, 2018; Łuniewska 2007). The development of finance means that investors, in order even more effectively to manage risk look for new solutions and approaches supporting investment decisions. One of them may be building a portfolio of companies for which one of the essential elements of operation are aspects of corporate social responsibility (CSR). The focus of investors on companies of this type may: constitute an alternative in the process of selecting companies for the portfolio, and thus support the process of horizontal risk diversification and making investment decisions. The growing importance of corporate social responsibility in making investment decisions is a reasonably new trend in the capital market in the context of risk diversification.

The chapter aims to verify whether portfolio investing in companies stating the use of CSR can be effective. The conducted study will answer the question of whether it may be profitable to construct a portfolio of securities from companies declaring the use of CSR. The study is also to indicate whether considering only this type of companies (guided by CSR) in investing can be an alternative to making long-term investment decisions. The empirical study was conducted for selected companies form the Warsaw Stock Exchange.

2 Corporate Social Responsibility: The Basics

Corporate Social Responsibility (CSR) is a management concept in which companies in their activities take into account the ethical, social and environmental aspects of their operations, as well as relations with stakeholders such as customers, employees, suppliers, shareholders or relatives. The definition is well-conditioned in the literature on the subject (e.g., Brederecke and Dirk 2010; Altennurger 2017; Buglewicz 2018; Uziębło 2015; Waliszewski 2018) Being socially responsible means not only meeting formal and legal requirements by an organization but also investing in human resources, caring for the environment, relations with the environment, contributing to the growth of competitiveness. Socially responsible companies contribute to the implementation of the sustainable development policy, and their most important goal is effective profitability while taking care of social interests.

CSR applies not only to companies, but also to medium and small enterprises. Currently, CSR is the basis of management, recognizing the socially responsible contribution to sustainable development. Enterprises, apart from economic indicators, started taking into account non-economic development criteria. Contemporary corporate management to create a socially responsible system at the level of economic, social and environmental economic activity.

In order to deserve the title of socially responsible, a company must follow CSR standards. The most important social standard that is responsible for ISO 26000. What about future events that will be incorporated into the topic, wants to be socially. As part of the 26000 standard, the scope of activities is specified:

1. Organizational governance—analysis of analytical data, research, codes and CSR strategies, create mechanisms for managing the social responsibility process, and discover their achievements in the field of CSR,
2. Human rights—preventing mobbing and discrimination,
3. Work practitioner—an area that applies to all work related to the company's employees. These activities are to ensure safety in workplaces, services that increase qualifications, comfortable working conditions and employee volunteering,
4. Environments—favor the use of resources, emission or generation of waste. All these activities are to minimize the negative impact on the environment,
5. Honest organizational practices—these are ethical procedures in dealing with literature. Issues related to this area are to counteract corruption or unfair competition,
6. Consumer issues—honest and transparent marketing activities, reliable information,
7. Social involvement and community development—cooperation with non-governmental organizations, support for health and educational groups, donating money needed.

Corporate social responsibility in times of progressive globalization of a double role. From one point of view, it is time to protect against the negative effects of globalization that come with action, it protects the environment and society. On the other hand, the progressing globalization has bothered the contemporary temporary conditions in the conditions of strong competition and increasing pressure to act in accordance with the amount of responsibility. This fact makes us present socially responsible companies that can count on success, helping to be socially responsible nowadays is a necessity.

3 CSR on the Warsaw Stock Exchange

The phenomenon of socially responsible business has been present on the Polish securities market for over 10 years. Activities in this area were carried out by the Responsible Business Forum in cooperation with the Polish Institute of Directors. The first one focused on promoting the idea of CSR on the Polish market, and conducted remedial and educational processes. The results of this work are conferences and the publication of reports on the state of development of responsible business in Poland. The second body focused mainly on creating regulations. The work resulted in the document "Good Practices of Public Companies" (Giełda Papierów Wartościowych "Good Practices 2005" 2005, pp. 2–10), which referred to three

basic areas: the functioning of general meetings, the activities of supervisory boards and management boards. The main rule that was necessary in the good practice reporting process was the "explain or complain" idea. The company informed about the fulfillment of a given practice or explained why it would not be fulfilled. From the end of 2006, works on new principles of good practice for listed companies were carried out. From the beginning of 2008, new regulations came into force under the name of "Best Practices of WSE Listed Companies." The focus was on the openness and transparency of listed companies, improving communication between companies and investors, and increasing the protection of shareholders' rights. In 2009, a new concept of CSR research was introduced, which was combined with the measurement of the value of companies using the stock exchange index. As part of the project, a definition of social responsibility was adopted, which assumes building good and lasting ties with the business environment, all interested parties: employees, suppliers, customers, local community, shareholders, as well as care for the natural environment. They make business decisions, assessing not only their financial performance, but also social and environmental performance.

There are three stages of creating a responsible business. The first is to isolate the companies with the highest liquidity. These are companies that will be included in the WIG20, mWIG40 and sWIG80 portfolios. The three above indices are updated on a quarterly basis, while the RESPECT index is selected annually. The second stage is the assessment of companies in terms of corporate governance, information governance and relations with stakeholders, which is carried out by the Warsaw Stock Exchange together with the Association of Stock Exchange Issuers, after analyzing reports published by enterprises. There are three criteria for evaluation:

1. Charges of sanctions with regard to the fulfillment of information obligations within 6 months back,
2. Impeccable reporting in the field of Corporate Governance and information governance (quality of current reports, whether previous reports have been corrected, the number of corrections and their importance),
3. Running the website according to the WSE guidelines. The website is assessed in terms of the quality of communication with investors, its speed and effectiveness. This applies in particular to the speed of answering questions about investor relations using the website, and the publication on the website of the company's basic documents, professional CVs of members of the governing bodies, current and periodic reports, information on the shareholding structure, financial ratios, placing links to other websites on the website. Capital market institutions, the use of modern methods of communication with investors and the availability of the website in English.

The last stage is a collective assessment of the activities undertaken by the enterprise. The assessment is carried out on the basis of a questionnaire completed by the companies and the results of its verification. The criteria that are used in the evaluation process consist of the following categories:

1. Enivironmental, i.e., environmental management, biodiversity, environmental aspects of products and services,
2. Social, including OHS, human resource management, relations with suppliers, stakeholders, social reporting,
3. Governance is strategic management, code of conduct, risk management, audit and control system, customer relations.

For the purposes of classifying companies applying the principles of corporate social responsibility, indexes were created that allowed companies to be grouped to support the assessment of investing in this type of securities. Creating indexes, while disseminating the idea of socially responsible business, was to answer the questions whether investing in companies meeting CSR requirements is burdened with lower risk, and whether such companies guarantee higher rates of return ("Social Responsibility Indexes as a Method for Measuring CSR Activities in Enterprises, Legal, Economic and Sociological Movement, No. 7/2017, Czopik Sz., pp. 245–251).

4 Methodology of the RESPECT Study

RESPECT Index (www.respectindex.pl/opis_projektu), i.e., the index of responsible companies, had its beginnings on the Warsaw Stock Exchange in 2009. It includes companies managed in a rational, sustainable and responsible manner.

The RESPECT index consists of listed companies operating by the highest standards of management, information and corporate governance and investor relations. Moreover, acting in the field of pro-ecology, they conduct good practices in social and employee relations.

The scope of the RESPECT Index survey covers companies listed on the Warsaw Stock Exchange. The RESPECT Index plan includes three base parts: survey, ranking and index.

The first stage is carried out based on the available data. In terms of responsible business, companies are qualified based on a survey completed. The questions on the form are quantitative and qualitative. The company provides measurable information, such as the financial result or the number of employed women, but also non-measurable information, for example, whether the information is provided in the remuneration of the supervisory board. The data presented in the survey are calculated following the established rules.

In the next stage, after establishing unit indicators, companies are ranked according to the decreasing value of the indicator. The ranking is also the basis for creating the initial rating. The final selection of the group of companies with the highest rating is also the selection of the list of index participants.

5 CSR and Risk Diversification

The selection of companies for an investment portfolio is a complex process, and it takes place based on various methods. The classification of companies is based on the information contained in the fundamental analysis, which allows diversifying the investment risk. The essence of diversification is to create an investment portfolio in such a way that it meets acceptable by an investor's level of risk and rate of return. The investor's task is to create the most effective portfolio, which means in the classical approach minimizing the portfolio risk at a given level of return or maximizing the return for a specific level of risk.

In terms of risk diversification, different approaches can be used: classical and non-classical. In classical terms, the basic characteristics that an investor pays attention to when building a portfolio are the rate of return and share risk. The non-classical approach is broader and includes the concepts of vertical and horizontal risk diversification. Non-classical diversification combines information from fundamental analysis and quantitative methods to reduce risk as effectively as possible. In the context of CSR, horizontal diversification is of particular importance. Horizontal diversification focuses on aspects related to the "qualitative" approach to company evaluation. Companies that are selected to build a portfolio of securities are to be "good" in terms of long-term investments, e.g., have fundamental strength (which results from the aspects of the company's functioning as an economic entity). Companies operating strategically and in the long term, focus not only on survival in the market but also generate their value in an economic and non-economic sense. In the first case, it refers, for example, to elements related to positive financial results, in the second case, it focuses, for example, on the positive assessment of the company by stakeholders. It is in this second area that there is a place for corporate social responsibility (CSR). Hence, in horizontal diversification, an effective method may be to include companies guided by CSR in the construction of the portfolio. Companies of this type usually have an established market position and are positively perceived by stakeholders, which is not without significance for the assessment of the risk of investing in such companies.

It is worth to note that many modern investors perceive changes in the environment that have an impact on investing (e.g., as a result of globalization, the number of risks related to business activity has increased). Unpredictable climate changes drastically change the conditions of doing business. On the other hand, environmental regulations introduced by the administration and various ethical and pro-ecological obligations imposed on companies have an impact on the operating conditions of enterprises. Besides, phenomena such as terrorism, energy security, collapse in financial markets supplement the investment field with new risk elements (World Economic Forum Global Risks 2009).

As a result of the financial crisis, there was a decline in confidence in traditional evaluation systems. A good example is rating agencies, once considered oracles on the capital markets, but in the time of crisis, securities that had high credibility ratings turned out to be "toxic assets."

All these elements cause that currently, the importance of new information carriers for investors is growing. Instruments related to the sphere of corporate social responsibility are of particular importance. Investors are increasingly paying attention to such sources of information as:

- Environmental reports
- Social reports
- Results of environmental and social audits
- Management standards (e.g., environmental, social, stakeholder relationship management standards)
- Responsible companies rankings
- Stock indices based on socially responsible companies
- Opinions of independent experts, including assessment, carried out by NGOs and think-tanks.

6 Assessment of Investments in RESPECT Index and WIG20 Companies

In order to test the effectiveness of investing in companies that take into account CSR aspects in their operational strategy, a simulation was carried out. Two categories of investment portfolios were built: (1) from companies included in the RESPECT—-twenty companies with the highest percentage share in the RESPECT Index and (2) form companies included in the WIG20 index. The year 2018 were selected for the analysis in both cases.

For the surveyed companies based on the collected data from the portal (www.infostrefa.pl) regarding the 2018 year were calculated the weekly rates of return. The Solver tool was used for calculation the portfolio parameters. For both categories of portfolios was established the efficiency portfolio line. In the portfolios construction, was used the portfolio effect of the rate of return. It allowed for the determination of the volatility range for the expected rate of return

1. WIG20 portfolios—R0 ϵ (0.0004; 0.011),
2. RESPECT Index portfolios—R0 ϵ (0.0004; 0.0169).

Tables 1 and 2 present: the expected value (Rp) and risk (Sp) of the built portfolios, the shares of individual companies (xi), the number of shares (ni) that were included in the portfolios and the random volatility coefficient (Vs). The Vs coefficient was used as a criterion for selecting the optimal portfolio. The optimal portfolio was used to test the investment effectiveness and comparisons following the assumed research objective.

The variants of portfolios are marked with:

1. WIG20—WIG20_nr (“nr” is the following number of the portfolio variant).

Table 1 Estimated variants of the WIG20 portfolios

The portfolio variant	Rp	Sp	Vs	The number of shares in the portfolio
WIG20_1	0.0004	0.0208	52.00	8
WIG20_2	0.0016	0.0221	13.81	8
WIG20_3	0.0028	0.0238	8.50	8
WIG20_4	0.004	0.0258	6.45	6
WIG20_5	0.0052	0.0281	5.40	5
WIG20_6	0.0064	0.0309	4.83	5
WIG20_7	0.0076	0.034	4.47	4
WIG20_8	0.0088	0.0374	4.25	3
WIG20_9	**0.01**	**0.0418**	**4.18**	**2**
WIG20_10	0.011	0.0706	6.42	2

Table 2 Estimated variants of the RESPECT Index portfolios

The portfolio variant	Rp	Sp	Vs	The number of shares in the portfolio
RES_1	0.0004	0.0240	60.08	8
RES_2	0.0024	0.0262	10.92	9
RES_3	0.0044	0.0292	6.64	7
RES_4	0.0064	0.0331	5.17	6
RES_5	**0.0084**	**0.0381**	**4.54**	**4**
RES_6	0.0104	0.0489	4.70	2
RES_7	0.0124	0.1030	8.31	2
RES_8	0.0144	0.1686	11.71	2
RES_9	0.0164	0.2364	14.41	2
RES_10	0.0169	0.2535	15.00	1

2. RESPECT_Indeks wallets—RES_nr (“nr” is sequential number of the portfolio variant).

For further analyzes, portfolios with the lowest Vs. In the case of the WIG20_9 portfolio, two companies were taken into account for which the percentage share in the portfolio was: PGNiG (32%) and LOTOS (68%). In the case of the RES_5 portfolio, there were four companies: PGNiG (16%), LOTOS (79%), MILLENNIUM (2%) and TAURONPE (3%).

In order to assess the effectiveness of the portfolios, they were purchased and sold. The wallets were purchased on 02/01/2019. The portfolios were sold in three randomly selected periods: after half a year (06/28/2019), after a year (31/12/2019) and one and a half years (06/31/2020) from the date of purchase. Hypothetical investment capital of PLN 100,000 divided equally into two categories of portfolios of PLN 50,000 each. The results of the purchase and sale simulations are presented in the Tables 3 and 4.

From the data presented in Tables 3, 4, and 5, it can be seen that there is a loss on both portfolios, but the Res_5 portfolio gives a smaller loss. We would lose the least on sales 6 months after the purchase, in the case of the Respect Index it is 7.2% and

Table 3 Purchase-sale for the WIG20_9 portfolio variant

WIG20_9 portfolio composition	Share in the portfolio (%)	Purchase of a portfolio	Portfolio sale		
		02-01-2019	28-06-2019	30-12-2019	30-06-2020
PGNIG	32	15893.6	12056.4	9831.3	10330.8
LOTOS	68	34106.4	32879.7	32445.0	23291.4
amount	100	50000	44936.2	42276.3	33622.3

Table 4 Purchase-sale for the Res_5 portfolio variant

WIG20_9 portfolio composition	Share in the portfolio (%)	Purchase of a portfolio	Portfolio sale		
		02-01-2019	28-06-2019	30-12-2019	30-06-2020
PGNIG	16	7884.1	5980.6	4876.9	5124.7
LOTOS	79	39606.2	38181.7	37676.8	27047.2
MILLENNIUM	2	1018.6	1064.1	665.0	553.6
TAURONPE	3	1491.2	1159.0	1111.6	1599.6
Amount	100	50000	46385.4	44330.3	34325.1

Table 5 Comparison of portfolios WIG20_9 and Res_5

Portfolio variant		Wallet sale 28-06-2019	Starting balance 30-12-2019	Starting balance 30-06-2020
WIG20_9	Rp	–10.1%	–15.4%	–32.8%
	Profit/loss	–5063.85	–7723.72	–16377.7
Res_5	Rp	–7.2%	–11.3%	–31.3%
	Profit/loss	–3614.58	–5669.7	–15674.9

WIG20 10.1%. In the light of the presented analyzes, we can say that ECT Index is the right direction because even if there are loses on portfolios, risk management is all about losing less.

The year 2019 was not good in terms of investments; it was the year when the market was losing. When interpreting the obtained results, it should be remembered that the analyzed period is not the most favourable on the Polish capital market (WIG index –22.50%).

The year 2020 and the half-year surveyed was a downturn in the market and the economy caused, among others, by a pandemic—and here the stock market is very sensitive to this type of situation.

7 Conclusions

The study aimed to assess the effectiveness of long-term investing in companies that declare the use of CSR in their functioning. For this purpose, a portfolio of securities from companies included in the RESPECT index was built, and its effectiveness was assessed in comparison to the portfolio built in a classic way.

The portfolio, built of companies included in the RESPECT Index, turned out to be more effective than the classic portfolio. Although in the analyzed period we record a loss on both portfolios, the portfolio of companies declaring the use of CSR aspects recorded a lower loss in the analyzed periods of sale than the portfolio composed of companies from WIG20. The results of the study indicate that including in the process of selecting stocks for the portfolio as crucial information, the application of CSR aspects by companies may be profitable. Overall, the analyzed period was unfavourable from an investing point of view. The results obtained may be a consequence of the market decline that took place in 2019 and the economic downturn in 2020 (first half of the year), being an immediate consequence of the existing COVID-19 pandemic.

It is worth noting that the companies included in the Res_5 portfolio come from various sectors, which is also important for risk diversification. A significant element in the construction of the portfolio and selection of companies was participation in the Respect index and following CSR in their activities. It is worth noting that the measure of investment effectiveness is and will be the rate of return and the accompanying risk. The idea of socially responsible investing does not assume that ethical aspects are more relevant than economic but treats them as equal. The responsible investment must meet both conditions. The study was related to long-term investments, and CSR activities are an integral part of the company's long-term strategy. Therefore, they may be beneficial for investors in the long-term investment horizon.

It should be noted that the conducted study was general and focused only on the assessment of the effectiveness of a portfolio for a certain category of companies—guided in their functioning a CSR. This approach is important in the context of horizontal risk diversification and security selection to the portfolio. Due to the specificity of the CSR category itself, it is worth paying attention in the future to which factors in the area of CSR may have a significant impact on the results of long-term investment, including horizontal risk diversification. This type of research should also be supplemented, taking into account other variants of the portfolio structure (e.g., fundamental portfolio) or at other time intervals. Generally, all of these elements are very important for investment decision making and risk management.

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A Study of the Effectiveness of Corporate Governance in EU Small States Financial Services Firms

Simon Grima and Frank Bezzina

Abstract The objective of this chapter is to uncover the factors that drive effective corporate governance in licensed financial services firms (FSFs) in seven small states of the European Union so as to explain what drives board behaviour. For the purpose of this study, small states are defined as those with a population of three about three million or less. Cyprus, Malta, Luxembourg, Lithuania, Slovenia, Latvia and Estonia fall into this category. The approach adopted in this study was to conduct a survey to derive a Board Effectiveness Measure (BEM) with the secretaries of 164 Boards of Directors (BODs) in the seven small states under consideration to assess the drivers of BOD effectiveness. We then used a number of objective criteria to test the statistical relationship of these criteria with Board effectiveness. Among other findings, the study revealed that the BODs' Effectiveness Measure (BEM) increased with the academic level of the directors and the number of Boards on which Board members are approved.

Keywords Financial services · Small states · European Union · Corporate governance · Board of directors

1 Introduction

The objective of this chapter is to uncover the factors that drive effective corporate governance in Licensed Financial Services firms (FSFs) in seven small states of the European Union so as to explain what drives board behaviour. For the purpose of this study, small states are defined as countries with a population of about three

S. Grima (✉) · F. Bezzina
Faculty of Economics, Management and Accountancy, University of Malta, Msida, Malta
e-mail: simon.grima@um.edu.mt; Frank.Bezzina@um.edu.mt

K. Nermend et al. (eds.), *Decision-Making in Management*, Contributions to Management Science, https://doi.org/10.1007/978-3-030-67020-7_13

million or less. We will therefore, in this chapter, lay out the results of a systems view of governance, using the cases of European Licensed Financial Institutions in Cyprus, Malta, Luxembourg, Lithuania, Slovenia, Latvia and Estonia, to determine the internal and external drivers of effective governance in small country states.

All financial institutions within the EU require a governing board, and this board is subject to authorisation by their respective authorities and requirements set out in national and European Union (EU) requirements and guidelines. The latter requirements and guidelines, which include Directives, Law, Rules, byelaws and other soft-law such as standards, are a means of ensuring harmonisation of Corporate Governance culture across the EU states. However, governance practices are expressed by the activities of the board members and their expectations. These can be imposed externally by, for example, legislation or the market or self-imposed through internal requirements set by shareholders to ensure that the boards act in accordance with their (the shareholders) appetite and tolerance (avoiding the principal-agent problem) (Gazley and Nicholson-Crotty 2018).

After the 2008/2009 financial crisis, regulators imposed stricter regulations and intensified supervision in relation to governance, especially on the financial services sector within the EU. They believed that the failure in corporate governance of financial institutions led to their demise. This brought on an adverse effect on the financial services industry and in turn, the economy stifling creativity and innovation. More responsibility was placed on Boards of Directors (BOD), especially the non-executive board members, who needed to oversee the undertaking and its management, with the aim of ensuring that none of these took excessive risks beyond the appetite and tolerance of the shareholders (Grima 2012).

However, financial institutions' risk-taking is essential for development and sustainability and over-emphasis on inflexible prescriptive requirements/policies may constrain wealth maximization, since this may foreclose risk-taking and in-turn threaten systemic stability and profitability in the longer term.

As a real case example of the need to take risks for the sustainability of economic growth and development of the economy, is the new reality faced post the 2008–2009 financial crisis. Following this, imposed regulatory controls have supposedly ensured a safer economic environment, with financial services providers holding increased capital buffers and liquidity. However, due to increased controls and governance responsibilities over the perceived risks, we can see from the Global Financial Stability Report (2014) that many banks did not have the financial strength that enabled them to provide the required amount of credit to support in a sustainable manner the needed recovery of the economy. This was echoed by Fernández Muñiz et al. (2020), who studied the dimensions that underlie the new distinct risks to the global banking sector. Bringing to light the fact that it is not enough to stabilize and repair balance sheets by determining controls over risk, since the new challenge faced by financial services providers is now the adaptation of their business models to the post-crisis realities of the new markets and the new regulatory environment (Viñals 2014; International Monetary Fund 2014).

This chapter is organised in six sections. Following this introduction, Sect. 2 presents some information relating to the financial services sectors in the seven EU

small states. The section that follows contains a literature review relating to effective governance in FSFs in general and in the EU in particular. Section 4 describes the study design and the methodology adopted to assess the factors that drive governance effectiveness in FSFs. The findings are presented in Sect. 5. The chapter concludes with a discussion on the implications that can be derived from the findings.

2 The Financial Services Sector in Small EU States

The seven small EU states covered in this chapter are supervised by the European System of Financial Supervision (ESFS)[1] and the national supervisory authorities of EU member states. What follows are brief descriptions of the financial sectors in these states.

Cyprus is a member of the European Union since 2004, joining the euro zone area in 2008. The Cyprus Securities and Exchange Commission (CYSEC) "Επιτροπή Κεφαλαιαγοράς Κύπρου" and the Central Bank of Cyprus is in charge of the oversight and regulation of the financial services industry.

With an industry of more than Euro 1 trillion globally, trusts financial planning is a very important service in Cyprus. These include asset protection, estate and tax planning, charitable/purpose, confidentiality, wealth management/Investments, share ownership/pensions fund, insurance and protection against exchange control. Cyprus' banking sector is comprised of two tiers: domestically oriented banks and international banks. The banks with a foreign origin consist of around 30 institutions, which mainly carry out international banking business and have limited interaction with the domestic Cypriot economy. Moreover, it is a natural hub for wealth management and family offices. The investment fund sector assets under management has reached a level of Euro 4.8 million in 2018 with the number of funds standing around 120. The Insurance market is rather small with over 30 insurance companies offering services both on the commercial and personal lines insurance. In addition, Cyprus's foreign exchange broker industry hosts many of the global giants in the field. The Direct Contribution of Financial and Insurance activities to total Gross Value Added generated in the Economy was 11.17% at current prices in 2017, an annual decline rate of 0.71% (CYSEC 2019; Statista 2018b; Insurance Association of Cyprus 2019; CIFA 2019; Trading Economics 2019).

Estonia is a member of the European Union since 2004, joining the euro zone area in 2011. Since 2002, The Estonian Financial Supervisory Authority (EFSA) (Finantsinspektsioon) operates as a joint supervisor of banking, insurance and secu-

[1] The European System of Financial Supervision (ESFS) is a network cantered around three European Supervisory Authorities (ESAs), the European Systemic Risk Board and national supervisors. Its main task is to ensure consistent and appropriate financial supervision throughout the EU (More inflation is available at: https://www.bankingsupervision.europa.eu/about/esfs/html/index.en.html).

rities markets. Although the share and number of banks have decreased slightly, the Estonian financial sector is still bank-focused with assets of banks still accounting for around two thirds of all financial sector assets. In 2016, the assets of the five largest credit institutions account for some 90% of the total assets of the banking sector, making the banking industry in Estonia among the most concentrated in the EU. About 80% of the assets of investment and pension funds are managed by three large fund managers. Insurance is a small share of the Estonian financial sector with received premiums in 2016, accounting for 1.9% of GDP. 85% of life insurance premiums went to the three largest companies, while the market shares for non-life insurance, are divided a bit more evenly. Although the total value of pension funds in stood at 15% of the GDP in 2016, most were mandatory funds. The total value of investment funds stood at 4% of the GDP as at 2016. This being one of the lowest percentages in the EU (EROSUSTEEM 2017). The Direct Contribution of Financial and Insurance activities to total Gross Value Added generated in the Economy was 3.818% at current prices in 2017, an annual growth rate of 2.95% (OECD 2017a, b, 2019a).

The Estonian banking sector consisted of 17 banks, nine of which are credit institutions and eight are operating as branches of foreign credit institutions with total assets of Euro 25.2 billion (equivalent to 110% of Estonian's Gross Domestic Product (GDP)). These Banks have in the main, been dominated by foreign capital (90% of banking sector assets) and have proven to be among the strongest in the EU in terms of profitability. However, there was a decrease in profits between 2018 and 2019 of around 1/5th, which resulted because of the structural changes in the banking market (Riisalu 2019).

Latvia is a member of the European Union since 2004, joining the euro zone area 2014. The Financial and Capital Market Commission (FCMC) (Finanšu un kapitāla tirgus komisija (FKTK)) is in charge of the oversight and regulation of the financial services industry. The Financial and capital market participants are issuers, investors, banks, insurers, insurance brokers, reinsurers, reinsurance brokers, private pension funds, regulated market organizers, depositories, investment firms, investment management companies, alternative investment fund managers, credit unions, external credit assessment institutions (rating agencies), payment institutions and electronic money institutions. Banks dominate the market and are divided into two segments. The domestic-centred banks, which are dominated by Scandinavian banks and their branches, and banks, which focus in the main on servicing non-residents with no links with the domestic economy (OECD 2016). The Direct Contribution of Financial and Insurance activities to total Gross Value Added generated in the Economy was 4.0% at current prices in 2017, an annual decline rate of 18.88%. This is now changing and Banks are trying to focus on the local market and the share of non-residents is decreasing (Central Statistics Bureau Latvia 2018; OECD 2019a).

After 2018, economic growth in Latvia continued and Gross Domestice Product (GDP) increased by 2.2% amounting to resulting as Euro 30.50 billion in 2019. The Banking sector is now more secure and reforms that have taken place since 2018 has been very effective to curb financial crime, being one of the first member states to

successfully implement all 40 of the Financial Action Task Force recommendations. Infact, Standard and Poor (S & P) global rating was upgraded to 'A'+ from ,'A'. In 2020, 19 banks operated in latvia, including 13 credit institutions and 3 branches of credit institutions, dominated by Nordic banking groups.

Total assets of Latvian banks were EUR 23.20 billion as of December 31, 2019. The assets increased by EUR 0.25 billion or 1% in the fourth quarter of 2019, the increase was 0.33 billion EUR during the year 2019. The assets were EUR 31.9 billion at the end of 2015, it had negative trend since 2016. Main reasons for assets' decrease were the changes in business strategies and business models, optimization of capital expenses, as well as the license withdrawal of ABLV Bank (Jēkabs Īvāns 2020).

Jēkabs Īvāns (2020) further highlights that "the Latvian banking sector is stable, resilient and well capitalized and committed to embedding a culture of compliance while developing products and services that support the economy being shaped by environmental, social as well as governance challenges".

Lithuania is a member of the European Union since 2004, joining the euro zone area in 2015 and the largest in the Baltic States. Its financial sector is mainly concentrated on the domestic market with six retail commercial banks and eight EU bank branches. 'Lietuvos Bankas' (Bank of Lithuania), a member of the Eurosystem, is the single financial market and institutions supervisory authority since 2012. Retail banking represents the bulk of financial services operations, with the main income received from loans (68%), while deposits account for 80% mainly in current accounts. Other market participants include credit unions, insurance, credit providers, payment institutions, e-money institutions and brokerage firms (OECD 2017c, 2019b). The Direct Contribution of Financial and Insurance activities to total Gross Value Added generated in the Economy was 2.040% at current prices in 2017, an annual decline rate of 1.02% (OECD 2019a).

Radzevičiūtė (2019), highlights that the Lithuanian economy maintained growth momentum with real GDP growing by 3.6% in 2018. "Four banks and ten foreign bank branches are operating in Lithuania since the end of 2018 dominated by the subsidiaries of large Scandinavian banks. Fintech and digital banking has gathered pace with new digital services introduced for consumers in 2018.

"The capital adequacy ratios of Lithuanian banks exceeded the established standards, and are one of the highest in the EU. The profitability indicators have also remained sustainable, enabling banks to function stably and fulfil their natural function—to finance the economy and stimulate economic growth" (Radzevičiūtė 2019).

Luxembourg is one of the six founding members of the European Union. The Commission de Surveillance du Secteur Financier (CSSF) is in charge of the oversight and regulation of the financial services industry. Luxembourg's three traditional strengths, however, involve its activities in investment funds, banking and insurance. It boasts over 140 international banks having an office in the country. In the most recent Global Financial Centres Index, Luxembourg was ranked as having the third most competitive financial centre in Europe following London and Zürich. The investment fund industry is the largest in Europe and second in the world behind the United States (Statista 2018a). The Direct Contribution of Financial and

Insurance activities to total Gross Value Added generated in the Economy was 28.087% at current prices in 2017, an annual growth rate of 3.56% (OECD 2019a).

Malta is a member of the European Union since 2004, joining the euro zone area in 2008. The Malta Financial Services Authority (MFSA) is in charge of the oversight and regulation of the financial services industry. Some 25 banks have established operations in Malta. Most of these banks are not active in the local market, conduct specialised asset financing, corporate banking, and trade finance services. The insurance industry is experiencing an upsurge especially in the captive insurance due to the presence of expert insurance management services and EU passporting rights. In addition, the fund sector is expanding in the specialist regime for alternative investment funds, known as Professional Investor Funds (PIFs), in addition to EU-certified UCITS funds and more recently Alternative Investment Funds (AIFs) with around 600 funds domiciled in Malta and fund platforms, managers and administrators who are servicing funds from Malta. Wealth management is also another area of importance where High-net-worth individuals, wealth managers and family offices avail themselves of the wide range of local investment vehicles, including trusts and foundations. The Direct Contribution of Financial and Insurance activities to total Gross Value Added generated in the Economy was 6.1% at current prices in 2017, a decline from a rate of 6.4% in 2016 (NSO 2018; MFSA 2014; MaltaProfile 2018).

Slovenia is a member of the European Union since 2004, joining the euro zone area in 2007. The Securities Market Agency (SMA) (Agencija za trg vrednostnih papirjev) is the competent authority for the supervision of investment firms, management companies and investment funds, brokers/dealers, mutual pension funds as well as for the public offers of securities and takeovers' procedures in Slovenia. Slovenia's financial system is dominated by the banking sector; however, the insurance and pension funds and other financial intermediaries, such as investment funds and leasing companies are gaining ground (OECD 2011). The Direct Contribution of Financial and Insurance activities to total Gross Value Added generated in the Economy was 3.797% at current prices in 2017, an annual growth rate of 3.27% (OECD 2019a).

3 Literature Review

3.1 Good and Effective Governance in Financial Services Firms

The Organisation for Economic Co-operation and Development (OECD 2004) states that corporate governance involves a relationship between the board of directors, the management, the shareholders and all other stakeholders to provide the

structure and roadmap for setting, attaining and monitoring objectives. The same publication states that effective corporate governance frameworks call for an "appropriate and effective legal, regulatory and institutional foundation". These typically include mandatory (regulations) and voluntary limits and parameters (standards and internal policies). The later usually varies from company to company and country to country and may be a result of culture drawn from specific circumstances, history and tradition, which content and structure might be adjusted as circumstances change.

The Financial Stability Board (FSB), in their thematic review on corporate governance-peer review report (2017), highlighted that a main responsibility of the board of directors of a company is to monitor the effectiveness of the company's governance practices and to make changes where necessary. However, they note that the focus of many regulators and enforcement relates more to the effectiveness of boards themselves, rather than on the overall governance framework put in place by the financial services firm itself. The belief of the regulators is that by putting the responsibility for a governance framework on the board, there is enough incentive for them to ensure effectiveness and adequacy of the governance framework. They explain that to be effective in financial services boards should oversee and ensure (1) 'Succession Planning', (2) that there is a nomination and appointment process, (3) the management of and address of potential conflicts of interest, (4) the integrity of accounting and financial reporting systems and (5) objective and independent judgement (FSB 2017) [Statements 9, 11 emerged from this paragraph].

3.2 The Role of the Regulator

The Group of Thirty (2012) contend that the regulator plays an important role in influencing corporate culture and governance. In fact, they note the regulator's responsibility for ensuring that the financial services operate for the public good by guaranteeing that operations are carried out ethically, and are sound and safe. They further stress that without monitoring and enforcement carried out on the power and rights afforded to shareholders, stakeholders, and the public at large we would have disastrous behaviours.

However, they also note that governance is a living ongoing process, which cannot be static and fixed by a set of regulation, guidelines and procedures, and where effective and appropriate cultures are established, strengthened, streamlined and reinforced. The same authors argue that effective governance as an art for ensuring that different forms function well and are flexible enough to adjust so as to enhance the functions. They note that "it takes mature leadership, sound judgment, genuine teamwork, selfless values, and collaborative behaviours—all carefully shaped and nurtured over time".

3.3 Regulatory Restrains and Profit

The 2008/2009 global crisis has created considerable debate on financial regulation and the report by Lord Adair Turner (2009), who at the time was the chair of the UK's Financial Services Authority (FSA), identified several causes which led to failure of governance at all levels. As a result of this, BODs and management failed in their responsibilities to identify the risks and vulnerability of the institutions they represented. They were not prudent in their approach and clearly failed to identify and control risks. Instead, their focus was on performance and profits.

According to the Group of Thirty, although, ineffective governance at FSFs cannot be singly blamed as the only contributor to the global financial crisis and large losses during that last decade, it was often seen as an accomplice in the macroeconomic vulnerability. Effective governance can help in ensuring a positive contribution to prevent future crises or to mitigate deleterious impacts of shocks the firms might face.

3.4 Factors that Affect Effectiveness of the BOD

Literature on the factors that affect effectiveness of the BOD is of particular importance for this study as we shall base our survey on what emerges from the literature in this regard,

Although, it is important that governance structures and processes are in place and implemented, some authors argue that it is more important to see how well they function. Arnwine (2002), contends that the behaviour and culture of management and BODs is what matters, since failures are many a time caused by undesirable behaviour and values rather than bad structures [Statement 7 emerged from this paragraph].

The issue of appropriate behaviour is often discussed in matters relating to BOD effectiveness. Arnwine (2002), defines this concept as operating in accordance with the roles and responsibilities of the BOD, implying having respect for the company, the management, the employees, and other board members, being transparent about any conflict of interest that any board member might have, being able to distinguish in a timely manner between what matters and what is trivial and supporting the majorities opinion and decision taken to meet objectives [Statements 1, 3, 5, 6 emerged from the above paragraphs].

3.5 Desirability of a "One Sides Fits All" Approach

The responsibilities of board members of the EU financial services are laid out in manuals and guidelines, such as EIOPA (2015) which apply EU wide and MFSA (2014) in the case of Malta. The most important responsibility of board members

identified in these documents is to ensure the fitness and properness of management, board members, consultants, outsourced parties and specialised staff to take on specific roles within the company and able to ensure objective and independent judgement and identify and relate to the real issues, especially in difficult situations. Other important responsibilities include avoiding conflict of interest, aligning activities and resources according to the firm's strategic priorities, and maintaining the reputation of the organisation, ensuring continuity, succession ensuring profitability with due consideration of mandatory (example, regulations) and voluntary (example, internal policies) requirements.

An issue that emerges from the literature is whether a "one size fits all" approach is desirable. Becht et al. (2005), refer to the variety in the corporate-governance arrangements and suggest that it is unclear whether one form of corporate governance is superior to the other. Moreover, these authors explain that even though there is a supremacy of the Anglo-American financial and regulatory systems, the effects on performance and effectiveness are still puzzling and a one-size-fits-all corporate-governance regulation could not be appropriate. They contend that different types of corporate-governance regulations are needed for different industries and stages of their development. Similar views were expressed by Baldacchino (2013), Baldacchino (2017), Bezzina et al. (2014a, b) [Statements 2, 4, 8, 9, 10 and 11 emerged from these paragraph].

4 Study Design and Methodology

As stated, the aim of the study is to uncover the influencing factors that drive effective corporate governance in Licensed FSFs in the EU small states. Our study is influenced by Gazley and Nicholson-Crotty (2018).

For the purpose of this study, we constructed a semi-structure questionnaire. The respondents were 164 board company secretaries of different financial firms in the countries under consideration. These interviews were carried out, face to face over Skype and telephone calls directly by the present authors or though friends/peers who had access to possible participants (using a non-probability purposive and snowballing sampling methodology) between the 23rd May 2018 and 30th May 2019.

Although, the interview was mainly a structured one, we maintained an open-mind and allowed participants to comment further. These comments were recorded during the interviews. Once saturation was reached (after receiving 164 valid responses—between 21 and 25 responses from each jurisdiction) and when additional interviews were considered as not adding value, no more interviews were carried out (Marshall 1996).

Most of the participants (86.6%) had more than 5 years' experience as board company secretaries of different FSFs and are approved on more than five boards (57.3%). 49.4% of the respondents sat on Bank/Credit Institutions' boards, while 50.6% sat on boards of other institutions (i.e., Insurance, Insurance related

Companies, Investments and Funds including administration, trusts and management) and most worked in FSFs that employed more than 50 employees (54.3%).

A common practice in BOD research is to interview the Company secretary, CEO or Executive Director to assess the board performance (BoardSource 2012; Ostrower and Stone 2010). For this purpose, our interviews were carried out with the company secretary of the Boards in the FSFs under review.

The questionnaire consisted of 11 statements; on which Board Company Secretaries were asked to rate Board effectiveness of FSFs and 7 demographic statements. These effectiveness measures were identified through a review of literature on corporate governance summarised above and preliminary discussions with a few peers and risk management associations; using the thematic analysis approach as suggested by Braun and Clarke (2006). Participants were asked to rate each measure using a Likert scale ranging from: "Very Bad—score of 1," to "Excellent—score of 10".

The Board effectiveness statements were the following:

1. the Board's interaction with management;
2. the Board's support provided to management in difficult situations;
3. the Board's openness and transparency;
4. the Board's understanding of the real issues;
5. the Board's interaction with the CEO;
6. the Board's chair relationship with the CEO;
7. the organisations values and culture; and whether this is supported and reinforced;
8. the ability of the Board to apply business judgement on issues;
9. the Board ability to ensure succession planning;
10. the Board's ability to ensure objective and independent judgement;
11. the Board's ability to address possible conflicts of interest.

Using these responses to the survey, and assigning equal weights to each of the 11 components, we constructed the BEM as perceived by each respondent, with respect to the Board of which the respondent formed part.

Some respondents put forward additional comments. These were grouped and analysed using the thematic approach as suggested by Braun and Clarke (2006). The computed BEMs were then regressed against a number of objective variables relating to:

1. Board size (1 = 5 members, 2 = more than 5 members)
2. Board members' (Executive and non-Executive) academic level, averaged (1 = No degree or professional qualification, 2 = Formal Degree.
3. Number of different company boards on which the BOD members (Executive and non-Executive) sits (1 = up to 5, 2 = over 5)
4. Size of the firm (number of full time staff members 1 = up to 50, 2 = >51 staff members)
5. Country size, measured by the population size.

The above objective variables are a few main criteria that an authorisation units within the national financial regulators within Europe, consider when determining whether a director is fit to operate within a financial services provider and whether this financial service provider is fit to operate within the country and the EU. These result from the principle of proportionality of the EU regulations, which ask for authorisation justification for any decision taken to licence a financial services provider within a country and authorise members as board directors (Restoy 2019; Angeloni 2018; Basel Committee on Banking Supervision 2019; European Banking Authority (EBA) 2015).

- The expectation is that a larger number of board members allows for division of responsibility of key areas and therefore has a positive effect on the BEM. However, although this depends highly on the quality and experience of the individual board members, on the other hand communication can travel faster with smaller boards due to less bureaucracy and therefore, having a positive effect on the BEM.
- The expectation is that the board members holding a high academic level of education result in a more positive BEM. This since it is expected that academic qualifications provide the tools, background and knowledge for board members to understand and act faster on boarder aspects.
- The number of different company boards that the BOD member sits on, is expected to have a positive effect on the BEM, although this depends entirely on the individual board member's ability to use the experience gained from one board to the advantage of another, the size of the boards s/he sits on and the quality of the other board members. However, this may have a diminishing effect or a negative effect on the BEM for the same reasons, especially if the board member is unable to cope with the responsibility and workload.
- The expectation is that the larger firms are more efficient and have a positive effect on the BEM, due to economies of scale, better division of labour, research and development, larger pools of capital sources. Also, they can attract more qualified board members since they can make more lucrative offers. However, on the other hand smaller firms have the advantages of being leaner and communication towards the BOD is faster and hence any issues are addressed more promptly, resulting in a positive effect on the BEM.
- Again, one expects the larger countries to have a positive effect on the BEM, due to economies of scale constraints for very small countries due to a variety of reasons, including the limited pool from which to draw experienced personnel and less capital for research and development. However, on the other hand, similar to the case of size of a firms this could have the opposite effect on the BEM, since being small has its own advantages since one gets to the bottom of things quicker, with prompter communication and less bureaucracy.

The objective of the exercise is to assess to extent to which the BEM's are influenced by the objective criteria just described.

5 Limitations of the Study

In our study we interviewed the Board secretaries, which, as stated, is a common practice in such studies. This method has limitations since it relies on one perspective, making it difficult to separate differences in the performance of members on the same board, we expected objectiveness by these persons and we considered this to be a sound method.

This study is based on the participants' perception, and therefore a degree of subjectivity is to be expected. A control for assessors' bias is not included in this since we believe that being authorised positions (that is they have similar requirements set by EU financial services regulators) they would have very similar characteristics.

6 Results and Findings

The computed BEM measures derived from the survey are presented in Table 1, which shows an overall mean of 7.11 in a scale of 1–10 with a standard deviation of 0.7, as shown in Table 1. The table shows that the scores differed from one country to another with the highest BEM score pertaining to Slovenia (7.39) and the lowest to Luxembourg (6.62) and Latvia (6.05). It should be noted however that the scores of these latter two countries varied between respondents more than in the other countries, as indicated by the standard deviations.

The overall average of scores for all countries are shown in Table 2. While all the items produced means that were close to the BEM, one particular statement (i.e., 'The Board ability to ensure succession planning') produced a relatively low mean implying poor effectiveness in this regard. This would seem to suggest that in small EU states succession planning may be one of the main weaknesses with regard to BOD effectiveness.

The 11 statements in Table 2 have been sorted according to the rank of the mean, with the largest mean ranked 1st. The number on the right hand side of the statement relates to the order in which the statement was posed to the respondents.

Table 1 Average BEM scores for the seven countries

Country	BEM	SD	N
Cyprus	7.36	0.55	21
Estonia	7.27	0.43	21
Latvia	6.95	0.82	24
Lithuania	7.14	0.47	24
Luxembourg	6.52	0.98	24
Malta	7.17	0.59	25
Slovenia	7.39	0.52	25
All countries	7.11	0.70	164

Table 2 Board effectiveness measures (N = 164)

	Rank	Mean	Std. Deviation
(8) the ability of the Board to apply business judgement on issues	1	7.84	1.54
(7) the organisations values and culture and whether this is supported and reinforced	2	7.77	1.60
(3) the Board's openness and transparency,	3	7.60	1.20
(5) the Board's the interaction with the CEO,	4	7.60	1.14
(6) the Board's chair relationship with the CEO,	5	7.59	1.36
(4) the Board's understanding of the real issues,	6	7.57	1.61
(2) the Board's support provided to management in difficult situations,	7	7.33	1.24
(11) the Board's ability to address possible conflicts of interest	8	7.09	1.42
(1) the Board's interaction with management,	9	7.05	1.61
(10) the board's ability to ensure objective and independent judgement	10	6.84	1.01
(9) the Board ability to ensure succession planning	11	3.91	1.66
Overall (BEM)		7.10	1.06

Note: scale ranges from 1 = bad to 10 = excellent

Using the BEM information shown in Table 1, we conducted a multiple regression exercise, based on the following Eq. (1):

$$BE_i = \beta_0 + \beta_1 BS_i + \beta_2 AL_i + \beta_3 NB_i + \beta_4 FT + \beta_5 CT_i + U_i \quad (1)$$

$$i = 1,2,\ldots,164$$

Where:
BEM = Board efficiency measure (dependent variable)
BS = Board size
AL = Board members' academic level
NB = Number of boards members on which BOD members sat
FT = Number of full time staff members
CT = Country size

According to the t statistics and P values shown in Table 2, BEM increases (significant at the 95% level) when the board members hold formal academic qualifications (AL, t = 2.461 p = 0.15), when the 'number of Boards the members of the BODs are approved on' increases (NB t = 3.257, p = 0.01). On the other hand, BEM decreases as the board size increases beyond 5 members (t = −3.546, p < 0.001) and as the country size increases (t = 2.848, p = 0.005). Board member experience (t = −1.512, p = 0.133), number of full-time staff (t = −1.1046, p = 0.297) did not enter significantly in the estimated equation. As expected, the academic level of members of the BOD and the number of boards of which the members formed part, which possibly reflects experience of the members, emerged as positive in relation to BEM.

Table 3 Regression results

	β	SE	t Stat	P-value
Intercept	7.358	0.381	19.322	0.000
BS	−0.513	0.145	−3.546	0.001
AL	0.299	0.121	2.461	0.015
NB	0.420	0.129	3.257	0.001
FT	−0.154	0.148	−1.046	0.297
CT	0.181	0.063	2.848	0.005

Dependent variable = BEM
N = 164, R2 = 0.218

The results are shown in Table 3:

A debatable result is the negative relation between BEM and BS. This may be related to the fact that being usually larger, they have higher mandatory requirements, which enables better in-house training and provides a sense of more security and internal controls. However, surprisingly, the number of personnel in the organisation (which may be related to the size of the firm) did not yield significant in relation to the BEM.

The size of countries also would seem to have a significant positive effect on BEM, for the reason already explained associated with economies of scale constraints for very small countries, associated mostly with the fact that overhead costs cannot be downscaled in proportion to the population and their needs. Certain costs are intrinsically or regulatory imposed because of the nature of their operations.

Unexpectedly, the number of full time staff did not result as significant on the BEM, maybe because respondents feel that the directors are capable of determining the personnel needs of their companies and therefore believe that this is not an important criteria.

6.1 Additional Comments by Respondents

Some (64) respondents highlighted that succession planning is very difficult since board members, especially independent ones with the required expertise, experience and qualifications are difficult to find and approval of new candidates by the regulator is not readily forthcoming.

Other (52) participants commented on the fact that where the boards are large, the communication with management is not the best and at times this obscures judgement and increases complacency. They also commented that BOD members on large Boards are sometimes more concerned about covering their backs rather than being innovative and concerned about strategy and profitability. On the other hand, others commented that independent board members who are approved on more than one board are more effective since being exposed to different risks and objectives they can see the bigger picture. They noted that diminishing board

member effectiveness is relative and depends on many factors and not necessary on the number of boards a member is approved on.

A few (34) respondents commented on the fact that some boards especially the younger members or members who have never worked at the lower levels, find it difficult to understand real issues, take responsibility and maintain strong corporate values and culture. This was also expressed with regard to highly qualified academic independent board members who assign major importance to theory and models rather than reality.

Many (136) respondents commented on the fact that the new and stricter expectations and responsibilities put on Board Members has discouraged persons to act as directors, including those who have a low degree of appetite for innovation and those more concerned about internal controls than strategy. In small firms and small jurisdictions especially where innovation and efficiency is key to their development, this can present a major constrain of FSFs.

7 Conclusion

From the literature review presented in this chapter, we derived some definition of effective corporate governance with a focus on financial services firms, and the role of the regulator in matters relating to such corporate governance. We also referred to the seemingly conflicting objectives of maximising profit as against regulatory restraints of these firms.

An important aspect of the literature review related to the factors that affect the effectiveness of the Board of Directors. From such literature we identified which factors could be used to construct a BEM index.

The literature review also covered a discussion on the desirability of a "one sides fits all" approach. The studies to which we referred suggests that the regulatory pressures on corporate governance in the financial services industry of the small EU states could affect financial services firms. Heavy regulation in a small pool of expertise could render the firms in small states uncompetitive. This is exacerbated by the high overhead costs per capita in small firms. This possibility calls for more flexibility in regulatory requirements.

This study also constructed a BEM index, with information derived from a survey, with company secretaries of 164 FSFs as respondents. The responses yielded an average score of 7.1 from a scale ranging from very bad with a score of 1 to excellent with a score of 10. As expected not all attributes received the same score with the "Board's ability to ensure succession planning" being assigned the lowest score. Also the average score differed between countries.

Using the index derived from the survey, we carried a regression exercise so as to assess what factor affect the magnitude of the BEM. Our findings indicate that the BEM is influenced by the academic level of the Board participants, the experience of Board members and the size of the country where the boards operate.

Appendix

Table 4 Relationship with board demographics

ANOVA[a]						
Model		Sum of Squares	df	Mean Square	F	Sig.
1	Regression	30.43	12	2.54	7.69	0.000[b]
	Residual	49.82	151	0.33		
	Total	80.25	163			

[a]Dependent variable: board efficiency

[b]Predictors: (Constant), Malta, Board Member Academic Level (1 = No formal education/diploma/professional Qualification, 2 = Formal Degree), Industry: 1 = Credit Institution 2 = Other, Estonia, Cyprus, Board Member Experience on boards and working in the area (1 = up to 5 years, 2 = over 5 years), Luxembourg, Slovenia, The number of Boards Members are approved on (1 = up to 5, 2 = over 5), Lithuania, Number of full time staff members (Size of Company) (1 = 1 to 50 staff members, 2 = >51 staff members), Board Size (1 = 3 members, 2 = more than 3 members)

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The Effectiveness of Electronic Public Procurements

Niki Karypidou and Dimitrios Maditinos

Abstract The ultimate purpose of this chapter is to apply a holistic approach and analysis to the framework that governs electronic public procurements. This is a subject that has not been investigated to a large extent yet, and especially when it comes to the situation in Greece, no relevant study could be found until recently, in spite of the particular importance of the issue to the Greek economy, as well as the Greek public sector. The issue under investigation is approached, on the one hand, through literature review, and on the other hand, through primary qualitative research. Finally, it was found that electronic public procurements are characterized by higher transparency compared to previous years and contribute to enabling access to new markets. However, it is not easy for Greek small and medium enterprises to have access to online tenders, while the relevant terminology and legal framework should be simplified. Further, it is necessary to make the tendering procedures shorter, since it is noticed that the procedures currently take 1.5–3 months more, compared to the previous regime. The mandatory implementation of the electronic platform of the National System of Electronic Public Procurements (E.S.I.DI.S.) was introduced through the legal provisions of Law 4412/2016.

Keywords Electronic public procurement · E-procurement · Greek public sector · Competition · Decision making · Exploitation · Management · Simplification · Speed of transaction · Corruption · Resource saving · Public procurement

1 Introduction

Electronic public procurements are a new research field, since their application to purchases is still at a very early stage. As a result of the digital revolution, e-governance, unification and globalization of markets, and also the invention of

N. Karypidou (✉) · D. Maditinos
Department of Management Science and Technology, International Hellenic University, Kavala, Greece
e-mail: dmadi@mst.ihu.gr

K. Nermend et al. (eds.), *Decision-Making in Management*, Contributions to Management Science, https://doi.org/10.1007/978-3-030-67020-7_14

mechanisms to safeguard public money, electronic public procurements could not stay out of the picture. Public procurements constitute a major source of public investment in Europe, since they lead to economic growth and strengthen the single market. Their importance for the European Union is highlighted by the fact that they account for 19% of its Gross Domestic Product (European Commission 2015).

The survey started with searching for and processing scientific articles by using "electronic public procurement" as the main search term, and classifying those articles according to the area of interest, in order to identify the research gap that the survey will attempt to address in the following sections. Literature review—without setting any time limitation during the search—refers to the years from 2000 to 2016, with the total number of articles in the relevant field amounting to 50 (Fig. 1).

The effectiveness of electronic public procurements in Greece, and with regard to the Local Government Organizations (OTA), in particular, was the subject under investigation. Their mandatory application to tenders, in order to enter into procurement contracts with a value of over sixty thousand (60,000) euro, has been applied to supplies and services as of 8-8-2016, and public works as of 31-10-2017. Tenders take place by using the platform of the National System of Electronic Public Procurements (E.S.I.DI.S.), and access is provided through an online portal at www.promitheus.gov.gr (Promitheus 2019).

The research questions that the interviews focused on, with emphasis placed on the effectiveness of electronic public procurements, refer to five areas/thematic axes, according to the previously mentioned classification of the articles:

1. What is the opinion and views held by the respondents about the processing speed?
2. What is the opinion and views held by the respondents about resource saving?
3. What is the opinion and views held by the respondents about competition?
4. What is the opinion and views held by the respondents about transparency and corruption phenomena?

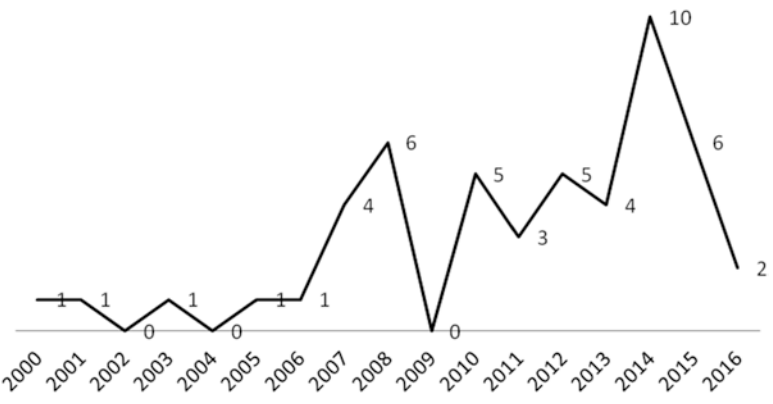

Fig. 1 Classification of articles per annum

5. What is the opinion and views held by the respondents about the simplification of the procedures followed?

2 Literature Review

2.1 Processing Speed

In the article of Hackney et al. (2007), it is investigated how information and communication behavior in electronic auctions affect organizational behavior and have an impact on the optimization of procurement contracts by cutting prices and promoting competition among suppliers. Research findings highlight the importance of proper preparation of the electronic auction through information and communication, and reveal the various factors and guidelines that could be used in the public sector for a successful implementation of online auctioning.

Also in the research study conducted by Tassabehji et al. (2006), the key role of information and the Internet is highlighted towards more flexible electronic auctions in both the private and public sector. The correlation is examined that exists between organizational flexibility and online auctioning, as well as the resulting advantages, while strategies are proposed and recommendations are made, in order to achieve organizational flexibility.

In the research study of Siddiquee (2008), focus is placed on e-governance as an innovation method in Malaysia, in order to increase the quality and efficiency of the online public services provided. Although there are initiatives in place for a digital society, their implementation is limited, not only because of the insufficient services provided, but also due to the slow pace of implementation, and also the insufficient access of citizens to online services, as a result of the absence of electronic equipment and unsatisfactory training provided to users.

The research study of Choi et al. (2014) is also on the same wavelength, where it is reported that e-governance is an innovative method of governance, and a lot of resources have been invested and effort has been made in that direction. In a case study that refers to Indonesia, an evaluation method is proposed for e-governance, in order to better deal with the problems of the developing countries, since they are poorer than the developed ones.

In his survey, Jang (2010) measures the impact of information quality and system and service quality on individual performance, through the use made and satisfaction received by the users, from a user perspective, arriving at a positive relationship between them, providing in this way information about how electronic public procurements can be designed and improved.

In the article of Gardenal (2013), a measurement model is proposed to define the performance of public procurement contracts in terms of quantity, concluding that electronic public procurements could boost efficiency, effectiveness, dematerialization (going paperless), transparency, and competitiveness. The adoption of

electronic procurement contracts changes the procedure that is followed when entering into procurement contracts. Taking into account the cuts in public spending, through organizational performance, it could be easier for a change in the procedure to take place. Furthermore, the model can be used to increase the responsibilities of all the stakeholders involved, whether this applies to the appointing authorities or the prospective contractors.

Another similar article is that of Chomchaiya and Esichaikul (2016), where emphasis is placed on a framework for the measurement of the performance of electronic public procurements from the point of view of internal stakeholders. Five groups of stakeholders were identified, i.e., the managerial staff, users of the services, auditors, finance directors, and employees who were responsible for the services. The survey ended with the conclusion that the group of finance directors, as expected, pay more attention to finance aspects, while the group that consists of managerial staff to how to support the procurement contracts. The framework measurement can be adapted to other countries, as well, and be used to design the measurement of the performance of electronic public procurements.

2.2 Resource Saving

In the article of Croom and Brandon-Jones (2007), the implementation and operation of electronic public procurements are assessed, based on earlier literature, where it is reported, inter alia, that there is a positive effect on the cost of procurements, which is divided into two categories, i.e., the cost of the procedure itself and the cost of buying the products. In this article, the effect of electronic public procurements is divided into five areas, reaching the conclusion that theoretical assumptions can also be implemented in practice. A key factor for this implementation is to improve the quality of internal electronic services.

In another article by Carayannis and Popescu (2005), the benefits of the Internet are highlighted towards more transparent and efficient procedures in the procurement of goods. Research in the article is mostly focused on electronic public procurements as a political instrument designed for a market economy and aimed at boosting productivity. A successful policy on electronic public procurements is a key factor for the implementation of a single market in the European Union and the achievement of its goals, such as providing access to new markets, creating new jobs, and establishing a better quality/price relationship for EU taxpayers. The lessons learned from the implementation in the EU are a useful guide for the Central and Eastern European Countries.

The relationship between quality and price was also cited in the article of Chen et al. (2011), where an innovative mechanism is developed, in order to distribute the benefits equally between buyers to increase the quality of the products supplied, and suppliers to cut down on cost. A revised mechanism is proposed, in terms of how the participants can increase social benefit, while equilibrium of interests is implemented between buyers and suppliers, at the same time.

The survey of Alvarez-Rodríguez et al. (2014a, b), refers to the common terminology used in organizations such as the European Union or the United Nations, in order to draw up and publish calls for tenders, facilitating, in this way, the attraction of participants. Public sector entities and government organizations are the biggest buyers in the EU, where public procurements account for 19% of the GDP of the EU, and thus, attention is turned to a more efficient and economical management of resources. The first step was taken by creating the official online journal of the EU, and the second one by using common terminology, where the participating bidders are asked to use the terms and codes that refer to the tender to describe the procurement contracts (this promotes more publicity and transparency, and the attraction of more participating bidders). The gap between human intervention and technical means is reduced, also achieving to save human resources, as an effect.

In the survey of Nurmandi and Kim (2015), where it was attempted to explore the performance of electronic public procurements, reference is also made, similarly to the above authors, to the importance of the human resources involved in procurement contracts, and it is proposed that good management practices are applied to them by both local and government organizations, since electronic public procurements are a valuable tool to curb corruption in public procurement contracts for products and services.

Barahona et al. (2015) discuss the implications of two different approaches towards the development of a national system of electronic public procurements, and stress the importance of the implementation of electronic public procurements, where organizational planning and the adoption of innovation-oriented strategies are required on the platforms used, since the existing problem is not clearly visible. They draw the conclusion that existing literature ignores organizational failure in Public Administration.

In the study of Raventós and Zolezzi (2015), it is attempted to analyze the effect on price as a result of online bids on pharmaceutical and medical products by using two regression models. Online bids are more efficient than traditional ones due to cracking down on corruption regarding the parties involved, reducing conflict of interest among the participants, achieving market aggregation, introducing an improved legal framework by using the platforms, and attracting more participating bidders. Through the empirical results, the conclusion is drawn that greater market aggregation can result in price cuts by 2.8%.

The research study of Walker and Harland (2008) is added to a constantly growing number of studies on the electronic public procurements made by both public and nonprofit organizations, investigating electronic public procurements made by the United Nations. More specifically, emphasis is placed on the factors that affect the adoption of electronic public procurements. The authors conclude that electronic public procurements are preferred in routine transactions, rather than in strategic deals, and besides, these procurement contracts are more likely to be chosen by development agencies of the United Nations rather than by humanitarian aid organizations. In spite of the fact that there was a policy in place towards the adoption of electronic public procurements, within 3 years, this policy was reversed, since the less developed countries and organizations are not supported equally.

Having as a starting point the theory of Malone et al. (1987), who used transaction cost to argue that the use of technology contributes to an easier entry to the market, such as, e.g., by cutting spending on coordination and information, and the higher chances for the products to be represented lead to a competitive advantage, authors Klein and Teubner (2000) attempt in their study to set up a framework about the strengths and threats that result from e-governance. By setting focus on the public sector, they propose the distinction of roles, opportunities, and threats for online intermediaries, depending on the diversity of the situation that they are involved in.

In the article of Rotchanakitumnuai (2013), the effect on electronic public procurements is examined, when it comes to the success factors of the four indicators of the balanced scorecard: organizational learning, internal procedure improvement, employee satisfaction, and economic benefit from electronic public procurements, with employee satisfaction having the most positive effect on financial cost cutting.

2.3 Competition

In their research study, Onur et al. (2012) examine the implications of a competitive environment on the cost of procurements. They arrive at the conclusion that the number of participating bidders and the participation of foreign bidders both have a negative correlation to the cost of procurements. Moreover, changes in the cost of procurements and services are more sensitive than the relevant changes in tenders for works.

As opposed to the above authors, Lewis-Faupel et al. (2016), who investigate electronic public procurements, where access to information is easier and the involvement of the human factor is reduced, find out that a competitive environment does not affect price cutting but only quality improvement. Further to that, electronic public procurements facilitate access for contractors who are not local and may offer better quality.

In the research study of Walker and Brammer (2012), through the use of a model, the relationship is examined between electronic public procurements and the supporting contracts. They reach the conclusion that communication with suppliers has a positive effect with regard to procurement contracts that refer to the environment, labour, security, and health, while there is a negative relationship between electronic public procurements and small and medium enterprises, since the latter do not have electronic means and access.

The research study of Karjalainen and Kemppainen (2008) is focused on small and medium enterprises, where it is reported that there are studies that evaluate the latter's benefits as suppliers, while there are fewer studies dealing with the entry barriers to markets. The obstacles faced by SMEs when participating in public procurements lie with their limited resources and special characteristics, due to their lack of legal expertise and experienced management. By analyzing suppliers

separately, i.e., municipalities and government organizations, it is found out that the absence of suitable electronic systems for product ordering and invoicing is responsible for the low participation of small and medium enterprises in public procurements.

In addition, small and medium enterprises are the subject of study in the survey of Albano et al. (2015), where electronic public procurements are a useful tool for the access of small, medium, and micro enterprises to the market of public procurement contracts. Existing data on the allocation of contracts to enterprises of different size are very limited, and that is where research attention is paid to, examining direct awards of low contract value, and the factors that are specifically responsible for awards to small and medium enterprises. The factors that are examined when entering into a procurement contract are the nature of the public buyer and the features of the product to be sold. Geographical distance increases risk, as the amount for entering into a procurement contract with a casual and anonymous supplier increases, and as a result, local authorities are more inclined to entering into procurement contracts for high amounts with local enterprises, while the design of an online platform with reliable mechanisms encourages the entry of "good" suppliers". The production capacity of larger enterprises makes the entry of smaller enterprises harder; however, the latter could improve their competitive position through joint ventures.

Geographical distance is also discussed by Cabras (2010), and as he concludes, electronic public procurements are not the top choice of local suppliers, while, on the contrary, they are preferred by suppliers who are not local, since the latter can have easier access in this way. The size of the company and the where it is based, as well as the scope of the company's activities and how they are connected to the use of electronic public procurements, are examined in research, with focus placed on the benefits of electronic public procurements, since, through them, the targets of the government budget can be met, and competition among suppliers bidding in tender calls by public organizations can become stronger.

The study of Waara (2008) deals with how contractual risks can be reduced, when Swedish authorities enter into public procurement contracts. Contractor reliability is a factor that can reduce contractual risk. Another factor is meeting in person with the contractor to resolve a number of technical issues that may arise in complex construction works, before the parties proceed with the completion of the award. In the public sector, however, the selection of the tendering procedure is stipulated by the law.

2.4 Transparency, Corruption

Information society has long played a supporting role for transactions that refer to the exchange of products, services, and information among businesses. As a result of the development of electronic procurement systems, opportunities for online transactions have increased. The survey of Dai and Kauffman (2001) is focused on

the type of incentives that apply to various online business models, in conjunction with their requirements, and adoption by buyers. The authors arrive at the conclusion that the electronic negotiation mechanisms that apply to public sector markets are needed more when companies experience uncertainty in the markets and a strong fluctuation in the quantities demanded.

Liao et al. (2003) refer to the Internet and the benefits derived from e-commerce, as a result of increased profit margins in products and services, and cuts in operating costs. Procurement contracts constitute a key area of interest, since they help enterprises to continue their operation in a competitive environment. Public procurement contracts, however, can become a source of corruption, scandals, and embezzlement of public funds. In addition to hiring unskilled staff, non-transparent procedures can also become an obstacle while entering into public procurement contracts. In their survey, they use a case study regarding electronic procurement contracts that are entered into by the Army, in order to reveal any problems, and design an environment based on transparent procedures, resulting in higher efficiency.

In the articles of Neupane et al. (2012), an investigation takes place about trust in the procedures of electronic public procurement contracts, and whether it is possible for those procedures to curb corruption. A number of variables are explored, such as usefulness, ease of use, and trust in electronic public procurements, while the dependent variable is the willingness to adopt electronic public procurements. The findings show a positive and significant correlation among the factors. The above authors, in another article of theirs in 2014, point out that one of the benefits of electronic public procurements is the reduction of corruption in the procedures followed when entering into public procurement contracts. Their research is based on literature review and the use of a theoretical model with three variables, i.e., monopoly power, information asymmetry, and transparency and responsibility, and examines the correlation of these variables with the dependent variable that refers to the willingness to adopt electronic public procurements. The results show that there is a positive and significant correlation among the variables, and they could be used in the strategies applied by countries to reduce corruption in public procurements. In addition to the above two studies, the article of Neupane et al. (2014a, b) deals with similar research, having added a fourth independent variable to the theoretical model, i.e., that of accountability, while the dependent variable remains the same, and the authors conclude again that there is a positive and significant correlation among the factors.

The study of Pavel and Sičáková-Beblavá (2013) examines, on a theoretical level, the factors that affect the efficiency of procurement contracts, including electronic public procurements and electronic auctions. Regression analysis is conducted on the five resulting questions. The research outcomes indicate that there is an indirect correlation between the bids made and the awarded price, where each additional bid reduces the price by 3.4%. Besides, the use of electronic auctions leads to an increase in the number of bidders by 0.7, which results in a price drop by 2.4%. The authors draw the conclusion that the indirect price drop and increase in the number of bids made are due to the transparency of electronic procedures, while the trust of tenderers rises.

With the trust of citizens being closely linked to transparency, the research study conducted by Smith (2010) uses a case study of two services, i.e., the system of electronic public procurements and the Inland Revenue, and reaches the conclusion that trust is built when electronic services meet the citizens' needs and affect them directly. In 2011, in another article of his in the same field, the same author concludes that although the use of technology can result in higher efficiency and transparency of the procedures, there are major obstacles that refer to the reliability of the institutional bodies, due to the discretionary nature and asymmetry of the power that they grant.

The article of Hardy and Williams (2011) investigates electronic public procurements as part of e-governance. Through their study, the authors aim at presenting their research approach, making thus the methodological path that they followed more transparent by using case studies during the implementation of electronic public procurements. The authors conclude that electronic public procurements are not only an amalgamation of scientific disciplines, theories, and practices, but they also encapsulate interdisciplinary and interactive research projects.

Through the use of technology, there is improvement in the quality and delivery of services, as well as in the trust that is generated in the citizens, while Smith (2011) studies the limitations that apply to trust in institutional bodies, through the use of e-governance, exploring the interaction of electronic services by using the Inland Revenue and electronic public procurements. The author arrives at the conclusion that there is limited improvement in reliability due to a competitive environment and conflicting values.

In recent years, mass media have been used for cost-effective information exchange. In theory, it may be possible to cut down on cost through the use of mass media when entering into electronic public procurements. As-Saber et al. (2014) turn their attention to this field, i.e., the potential and challenges of mass media with regard to electronic public procurements. The research outcomes highlight the limited role played by mass media when it comes to the public sector.

Seri et al. (2014) study the various areas of e-governance (with electronic public procurements also among them), and also investigate the influence applied to those areas by political, economic, social, and institutional factors. Through econometric analysis, the authors reveal the importance of broader penetration and a high level of training, when it comes to drivers that apply to most electronic services and their users.

Public procurements account for a large share of public spending among the EU member states. A way to cut spending on public procurements that is discussed in the EU is through market integration and harmonization, with the European Commission proposing for this purpose the entry into procurement contracts electronically. However, governance issues arise, which should be addressed by making good use of technology. Through this study, Khorana et al. (2015) describes the policy of the European Commission on electronic public procurements, and also elaborates a detailed structure for the framework, and highlights the key governance issues that should be addressed, in order to reach a successful adoption of electronic public procurements.

Based on literature, electronic public procurements are used in various countries to improve transparency, efficiency, and speed. In the article of Al-Aama (2012), the procedure is presented that is followed when entering into electronic public procurement contracts (i.e., the various stages and the current and future state) in a municipality in Saudi Arabia. It is also examined how electronic public procurements will contribute to the fight against corruption and improve the participation of citizens in governance.

2.5 Simplification of Procedures

The use of technology is a key policymaking tool for governments, with procurement contracts playing a leading role in reform change, since they are linked to accountability and transparency. Therefore, research conducted by McCue and Roman (2012) is focused on the evaluation of implementation, in order to be able to demarcate the current state. The authors conclude that electronic public procurements have not resulted in dramatic reform change yet, due to unsuitable platforms, organizational rigidity, and failure of the professionals bidding for the procurement contracts to participate in the design of electronic public procurements.

Based on the benefits that are associated with the use of the Internet, such as electronic public procurements and electronic auctions, where procedures move from paper to digital form, the study of Eadie et al. (2007) uses the construction sector as a case study, and determines the drivers, on the one hand, with the two most important ones being communication improvement and reduced administrative cost, and obstacles, on the other, with the two most important ones being related to transaction security and the legal framework of electronic public procurements.

Increased public spending and a drop in the economic resources of Municipalities comprise two of the biggest challenges of the twenty-first century that should be addressed by governments. The use of the Internet along with innovative technology tools have become a key contributor to resource saving and efficiency boosting. However, the public sector seems to have failed to take full advantage of these opportunities. In his study, Wirtz et al. (2010), in a similar wavelength to the aforementioned authors, focuses on the obstacles that apply to the implementation of electronic public procurements, drawing the conclusion that a more accessible and user-friendly regulatory framework is required, as well as greater employee familiarization with new technologies; however, and based on the research data collected, it is not possible to determine how significant the correlation between the factors is.

Electronic public procurements are major contributors towards a more efficient and transparent, as well as less bureaucratic society. Therefore, based on the benefits derived from electronic public procurements, the Manchester Ministerial Declaration (2005) set as a goal the digitization of procedures when entering into procurement contracts for all the EU member states by 2010. Nevertheless, this goal was not implemented within the deadlines set, with the exception of Portugal, which had already proceeded with the digitization of procedures since 2009. In their article,

and based on the case study of Portugal, Costa et al. (2013) attempt an inquiry into the obstacles arising from the mandatory implementation of electronic public procurements. The authors reach the conclusion that innovative procedures in public administration have a positive effect on the implementation of electronic public procurements, such as the simplification of procedures and user training.

The fact that multiple applicable laws arise as an obstacle to decision making, with the simultaneous requirement of these laws for transparency and simplification applied by directors, is the starting point of the article by Csáki and Adam (2010). Public procurements, which are an essential part of economic activity and a valuable policymaking tool for governments, have to take multiple applicable laws into account. The authors explore the regulatory framework of public procurement contracts, reaching the conclusion that the simplification of procedures is essential when entering into public procurement contracts. The complexity and multiplicity of regulations necessitate the simplification of procedures through the use of tools, such as electronic public procurements.

In the article of Vaidya and Campbell (2016), a definition is provided of electronic public procurements, with the use of information and technology through the Internet facilitating the entry into contracts between governments and contracts, in order for supplies, services, and public works to be bought by the public sector, with routine procedures becoming automated, and manual procedures being replaced by digital ones. Electronic public procurements are a powerful tool for reform change to be implemented by governments, so that they can reduce their fiscal deficits. The authors measure the efficiency of public procurement contracts through the methodology of content analysis, and draw the conclusion that three factors, i.e., electronic bidding, electronic cataloguing for system management, and electronic purchase have a positive and significant effect on electronic public procurements.

In the article of Hardy and Williams (2008), a theoretical and empirical approach to electronic public procurements is presented, through the study of information technology innovations that apply to public procurements. Electronic public procurements are more broadly associated with modernization, e-governance, and policies referring to local priorities. The authors conclude that it is required to develop a deeper understanding of the need for and complexity of socio-technical change.

Alvarez-Rodríguez et al. (2014a, b) study current technology, as well as research papers related to electronic public procurements, aiming to identify any advanced management systems for electronic public procurements that provide more adaptable, flexible, and faster decision-making in the procurement process. Although the tools and techniques that are utilized in electronic public procurements are capable of managing the latter, there is, however, lack of interoperability among the tools, combined with procedure dependencies, and failure to process the data and information. In this line, the key disadvantages of the procedure followed in the current electronic public procurements are presented. Through the Analytical Hierarchy method, a weight is assigned to each indicator and is used to make a comparison between traditional and semantic approaches.

In the article of Haim Faridian (2015), electronic public procurements are examined as a challenge into the future, and an innovation of public administration in the

context of project management, management of public procurement contracts, and e-governance. It links theory with practice, contributing knowledge on public procurements, governance, and public administration. According to the author, the resulting implications on the theory and practice are that, (a) public procurement contracts are governed by laws and regulations compared to the private sector, (b) public accountability is an institutional mechanism, as well as a method to control corruption, mismanagement of public resources, bad administration, abuse of power, and bribery, (c) electronic public procurements are an innovative way towards future governance and public administration, and (d) a more democratic governance is achieved in electronic public procurements.

3 Research Approach

In terms of methodology, the qualitative research method was used, because it focuses on: "Why?" i.e., the reasons and causes of a specific phenomenon (Zafeiropoulos 2015). According to Iosifides (2008), qualitative research focuses on the description, analysis, and interpretation of research problems, i.e., addressing questions such as "How?" and "Why?", and in order for researchers to be able to provide answers to these questions, an in-depth study of the procedures is required, applying the necessary flexibility every time. Besides, through this methodology, the various attitudes, views, life events, and experiences of the respondents can emerge (Kallinikaki 2010).

Research was conducted through: (a) an in-depth personal interview, via structured interviews and based on a specific interview guide, addressed to employees of the two Municipalities, and (b) case studies of tendering procedures that were followed by the above two Municipalities that take part in the interviews.

3.1 Sample Description

The research sample consists of six (6) participants in total who come from two municipalities of the country, which were selected, i.e., three persons from each municipality. All of them reported that they had many years of previous experience, and their job objective was related to public procurements, with roles such as head of financial services, competent officer for the conduct of either public works, supplies, or both, and employees who are members of the tender committee.

3.2 Research Limitations/Implications

The limitation that applies within the context of this chapter stems from the small number of people participating in the interview, i.e., six (6) in total. Nevertheless, in order to minimize such a limitation as much as possible, the researcher attempted to gather a diversified sample, i.e., heads of municipal authorities and staff members involved in electronic public procurements, employed by two (2) different municipalities that both took part in the survey. In addition to the former implication, interviews were performed by phone, limiting the available time and the physical contact with the interviewee.

3.3 Data Collection Method

Five of the aforementioned interviews were taken on the telephone (telephone interviews), and one of them was taken after the researcher met in person with the interviewee. Throughout the interviews, the researcher consulted the interview guide, and took personal notes, in order to facilitate the process of drawing conclusions.

3.4 Methods of Covering Research Questions

To cover the research questions, an interview guide was designed, which is composed of five (5) axes in total. Each axis consists of separate questions. The first axis consists of five (5) separate open-ended questions in total, and through these questions, it is attempted to cover any issues that are relevant to the processing speed. The second axis consists of six (6) separate open-ended questions in total, and through these questions, it is attempted to cover any issues with regard to saving human or economic resources. The third axis consists of three (3) separate open-ended questions in total, and through these questions, it is attempted to cover any issues regarding competition. The fourth axis consists of three (3) separate open-ended questions in total, and through these questions, it is attempted to cover any issues regarding transparency and corruption. The fifth and final axis consists of four (4) separate open-ended questions in total, and through these questions, it is attempted to cover any issues regarding the simplification of competition.

3.5 Case Studies

The case studies refer to the procedures that were followed in public tenders in the two municipalities of the country, which were selected by the author.

In specific, six (6) cases of tenders are described in total, four (4) of which refer to supplies, and two (2) to public works. The reference base is Law 4412/2016, under which, the compulsory application of the electronic process was introduced to tenders when entering into public procurement contracts, through the online platform that is available on the online portal of the E.S.I.DI.S. Half of the cases took place through the electronic process that was used, and the other three (3) cases describe the procedures that used to be followed by the previous regime that applied when entering into public procurement contracts, in order to draw conclusions after a comparison of the two regimes.

The online platforms that are used through the online portal of the E.S.I.DI.S. are two, one of which refers to tenders that take place for the appointment of contractors for services and supplies, and the other platform is for the appointment of contractors for public works. The selection of the case studies was made, in order to include both platforms The six cases refer:

- To the platform of the E.S.I.DI.S. for supplies and services:
- Description of the procedure for the appointment of a contractor for the supply of liquid fuels to the two Municipalities, in two tenders for each one, under the existing and the previous regime, respectively.
- To the platform of the E.S.I.DI.S. for public works:
- Description of the procedure for the appointment of a contractor for public works in one Municipality, in two tenders, under the existing and the previous regime, respectively.

4 Empirical findings

4.1 Case Study Results

In the following table, the time is illustrated that was required for each tender, i.e., from the start of the tendering procedure up to signing the procurement contract between the appointing authority and the contractor. Under the previous regime, and without using the E.S.I.DI.S. platform, it is observed that the tendering procedure was shorter in all of the three cases, by 1.5–3 months (Table 1).

Table 1 Comparative table of the tenders

1	Municipality A- Supply	E.S.I.DI.S.		6.5 months
2	Municipality A- Supply		Without	5 months
3	Municipality B- Supply	E.S.I.DI.S.		8 months
4	Municipality B- Supply		Without	5 months
5	Municipality A- Public Work	E.S.I.DI.S.		5.5 months
6	Municipality A- Public Work		Without	2.5 months

4.2 Interview Results

At this point, the results are reported of the interviews taken from the six municipality employees, with regard to the five axes of the questionnaire.

4.2.1 A' Axis—"Processing Speed"

A partial satisfaction was found out with the processing speed and the existing evaluation framework for electronic public procurements. Actually, at this point, it was proposed to reduce the movement time, shorten the evaluation procedures that were followed, and simplify them. The system of electronic public procurements, as it has been configured so far, is characterized by flexibility, without this implying that it does not need any further improvement and development.

4.2.2 B' Axis—"Saving Human Or Economic Resources"

It was found out that there is a significant contribution of electronic public procurements to cutting down on the cost of procedures and buying products, as well as enabling access to new markets, with medium contribution, however, to creating new jobs. The reason for their latter contribution is the fact that, in the context of the system of electronic public procurements, existing human resources should be specialized. This means that employees with specialist knowledge are required, which contributes to creating new jobs. Furthermore, electronic public procurements contribute to a moderate extent to equilibrium issues, i.e., the supply of products and services of high quality at the lowest possible price.

4.2.3 C' Axis—"Competition"

The research sample argued that strong competitive pressure contributes to cutting down on cost and increasing the quality of the products, works, and services offered. Moreover, it was found out that there is much room for improvement regarding the relationship between electronic public procurements and Greek small and medium enterprises, since, currently, and according to the research sample, this relationship is not satisfactory. Due to the fact that the participants argued that the majority of the above enterprises are excluded from electronic public procurements, this means that, on the one hand, the environment of electronic public procurements should become more accessible to and suitable for Greek small and medium enterprises, and on the other hand, these enterprises should make an effort to apply reforms and changes to their internal environment, in order for them to be able to correspond to relevant requirements by the appointing authorities.

4.2.4 D' Axis—"Transparency and Corruption"

In terms of the axis that refers to the factor of transparency and corruption, it is believed that the bargaining mechanisms of electronic public procurements are affected to a moderate extent by uncertainty in the market, as well as by demand fluctuations, while the role of further training provided to human resources to prevent cases of non-transparency and corruption is of equally medium importance, as opposed to the role of employees, which was believed to be extremely important, in order to eliminate those events. In order to reduce these adverse events, among other things, the factor of trust that is instilled by the appointing authority in the general public is extremely important.

4.2.5 E' Axis—"Simplification of Procedures"

Regarding the need for simplification of the procedures followed by the system of electronic public procurements, the research sample argued that, in general, there is still room for improvement, although the already existing state of the system of electronic public procurements is characterized by suitability and flexibility, in terms of the required procedures that should be followed, as well as by satisfactory security levels, when it comes to the issue of transactions performed. However, there is still room to apply further control to a number of red tape issues, such as, for example, the obligation to produce more supporting documents than necessary. Besides, all the participants argued that the terminology that is used in electronic public procurements is complicated, which makes them inaccessible. As an effect, it is argued that this particular point needs simplification.

5 Conclusions

Through this chapter and its findings, numerous and considerable benefits can be reaped by both the organizations and appointing authorities involved, as well as other directly involved stakeholders, by means of electronic public procurements. More specifically, this chapter serves as a guide to identify any strengths and weaknesses that exist in the context of electronic public procurements, in order for the directly involved organizations and authorities to be able to detect any points in need of restructuring and optimization, so that more and more prospective contractors are attracted by electronic public procurements and apply to take part in them, without considering their cases as rejected in advance. Furthermore, transparent electronic public procurements can effectively support governments, relevant ministries and suppliers in decision making processes as they have eased access to the overview of online tenders. Under these circumstances, they can discriminate low interest areas and by means of decision-making processes, change the legal framework or find alternative ways in order to attract more participants.

It is true that the current system of electronic public procurements is superior, from many points of view, than older existing systems, and is characterized by lower corruption and higher transparency levels, although this does not mean that there is no need for improvement, since, as it was found out through the case studies that took place in the research part of this study, the duration of the tenders from the start of the procedure up to entering into the procurement contract, was, for both municipalities, shorter by 1.5–3 months, before the introduction of the E.S.I.DI.S.

In addition, it is believed that, from the findings of this chapter, useful data can be drawn by the government and legislative authorities, as well, since it was found out that they should proceed with the simplification of the legal framework that governs electronic public procurements.

Nevertheless, beyond a personal evaluation of the existing situation that can be attempted by any reader, upon completion of the study of this survey, the author feels that it is appropriate to list some of his/her own proposals and suggestions, about actions that he/she believes that should be taken by the competent organizations and authorities. These actions are the following, in specific:

- Further simplification of the procedures followed, in terms of the system that governs electronic public procurements, especially with regard to the requirement to produce unnecessary supporting documents. Obviously, this would contribute to reducing the time period elapsing from the start of a tendering process up to signing the corresponding procurement contract, which, by the way, and after the introduction of the E.S.I.DI.S., is longer by 1.5–3 months than before.
- Connecting electronic public procurements to other national registries, in order for the stakeholders to be relieved from any red tape issues and procedures, and the required information details to be drawn through administrative channels, from the records held by these registries.
- Shortening the time period that is required, in order for each public organization to fully pay the supplier. In this way, even smaller enterprises, in terms of size and scope of activities, will not be discouraged to participate in the system of electronic public procurements.
- Paying due attention to providing ongoing further education and training to human resources that staff within the environment of the E.S.I.DI.S., as well as applying thorough control to reveal any possible cases of corruption. After all, as it has been shown, the most critical factor in causing such adverse events is the staff employed, and not the digitization itself that is applied to the individual procedures that are followed.

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Evaluation of the Efficiency of the Technology Transfer Process with DEA Tool in Lithuanian Higher Education Institutions

Jelena Stankevičienė and Lidija Kraujalienė

Abstract Technology transfer (TT) and valorisation activities at higher education institutions (HEIs) becoming more relevant to foster an entrepreneurial culture to commercialise research capital. This research analyses TT and valorisation phenomena and present the framework with DEA Frontier linear programming tool measuring the TT process performance of HEIs. The most critical aspects relating TT and valorisation have been identified: TT and valorisation office (TTVO) staff (helping in the symbiotic balance between HEIs and industry), transferrable production of R&D (research capital), technology inventor, academic recognition, competitiveness of the region, university dissemination works (technology marketing), country policy on TT, motivation tools, accessibility of cutting-edge technologies for industry, protection of IP, entrepreneurial culture, knowledge in TT process, structure, ability to change and take on strategic decisions on the allocation of resources, policy and management changing. HEIs TT process performance is measured with data envelopment analysis (DEA), constructed by the input-output principle. The model designed from seven Lithuanian HEIs, three inputs: international research projects; contract research; the number of research works; and three outputs: research staff in full-time equivalent; the number of PhD students; the number of master students. Research results confirm that DEA tool is fully applicable to evaluate the TT process performance of HEIs.

Keywords Technology transfer · Efficiency · Higher education institutions · Performance · DEA · Innovation

J. Stankevičienė (✉) · L. Kraujalienė
Vilnius Gediminas Technical University, Vilnius, Lithuania
e-mail: jelena.stankeviciene@vgtu.lt

K. Nermend et al. (eds.), *Decision-Making in Management*, Contributions to Management Science, https://doi.org/10.1007/978-3-030-67020-7_15

1 Introduction

Higher education institutions (HEI) are playing an essential role within the innovation ecosystem as the concentration of science knowledge inside HEIs. This knowledge should be converted into innovative solutions and finally commercialised. The following action will bring economic benefit, firstly for HEI and the country economy as well. Technology transfer and valorisation offices (TTVOs) of HEIs have the mission to rise innovative ideas from the walls of laboratories, find the way of a partnership with business companies and commercialise science knowledge for the market. In other words, TTVO ensures balanced symbiosis between HEIs and the private sector. Science-business partnerships help to encourage technology transfer (TT) activities and get lucrative deals. These results are concurrent with HEIs prosperity, recognition and prominence that desire all HEIs and their staff.

Efficiency in the context of higher education means the achievement of an objective when the minimum amount of resources is utilising. From the point of the HEIs, there are several efficiency types: financial, teaching, research, other (Munoz 2016). During the tracking of contemporary research papers and areas analysed, significant attention is paid for the TT and valorisation phenomenon at HEIs. However, execution of TT activities within HEIs is insufficient and not productive enough; furthermore, the tool to measure the efficiency of TT performance of HEIs is unknown. This chapter will provide the framework and tool to measure the efficiency of the TT process performance of HEIs.

The fact is that research organisations are becoming increasingly more effective in TT and commercialisation process. Still, these results were facilitated by international support programmes of European Union structural funds instead of own HEIs efforts. In the case of Lithuania, the innovation level is insufficient. By Innovation Union Scoreboard, in 2017 Lithuania is placed on the 16th position, when in 2016—on 25th, in 2015—on 26th, in 2014—on 25th, in 2020—on 19th position from 29th positions available (European Commission 2014, 2015, 2016, 2017, 2020). The Global Competitiveness Report shows the results of the global competitiveness index (GCI) of 148 countries around the world. This index reflects the performance of science-business activities, which have one of the essential roles for TT performance. The results of GCI for Lithuania are the following: 2017–2018—41, 2016–2017—35, 2015–2016—36, 2014–2015 m—41 position (World Economic Forum 2015, 2016, 2017, 2018). Prevail view allows to state that public-private partnership and innovation process in Lithuania is unproductive indeed. Therefore, TT and valorisation process should be improved and enhanced at HEIs. There are many studies on efficiency evaluation. Unfortunately, there are only several studies suggesting how to measure the performance of education institutions in general, and there is a lack of research on evaluation of TT and valorisation process.

Latter process plays an important role to connect researchers with business, thereby to address research findings to the market need. Science-business partnership

activity is a necessary instrument for the valorisation of research capital since they become realised into products or services.

For the more precise understanding of TT and valorisation terms, we provide more details. TT is being concomitant with following complex activities (Fig. 1):

1. identification of ideas (through internal marketing works, ownership dilemmas);
2. protection of intellectual property (IP), based on the internal patenting strategy;
3. conversion of ideas to understandable language;
4. marketing steps towards customers;
5. the realisation of IP through licensing (evaluation and negotiation processes), or creation of spin-offs (started from the business plan).

It should be stated that TT is complemented by the valorisation process, which is finally completed by commercialisation activities.

Commercialisation is leading by several selling steps towards invoking idea (valuable knowledge, technology, solution) becomes an attractive, successful product, service or result for served market need. We might be aware of commercialisation process elements such as identification of possible market for IP realisation, preparation of marketing strategy, brainstorming for solution's attractive design, production line, pieces of training need, IP management, financial aspects as raising capital.

The novelty and practical significance of this research are the following: a designed and empirically approbated original model to evaluate TTP efficiency of HEIs in Lithuania; the model can be further improved and adapted for TT assessments of efficiency to be also conducted in other countries; obtained data can be used for a long and short term planning, decision making at different levels (departmental, institutional, national) during HEIs management process, aimed at TTP improvement; the methodology developed in this research has proved to be

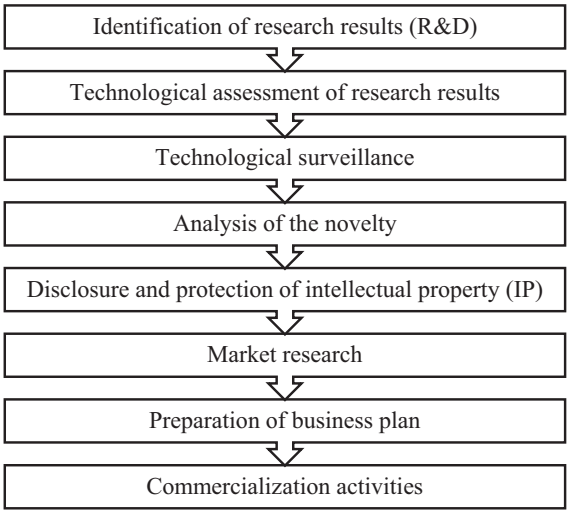

Fig. 1 Valorisation process (compiled by authors, adapted from Train 2 2017)

useful for the evaluation of TT efficiency; the DEA tool was used to measure the efficiency of TTP in HEIs, which are implementing science-business activities.

Roberts (1999) wrote that IP is the knowledge that works for the organisation and creates value as a result. Intellectual capital is the mix of resources and activities that allows an institution to transform a bundle of material, financial, and human capital into a system capable of creating stakeholder economic value (European Commission 2006). The invention is leading to a solution, which could be implemented for mass production and it that way commercialised (after protecting process).

An invention can be patented and in that way protected against the technology or method being copied in individual countries' market (it is crucial to choose territories) where is needed to protect the invention (here invention's creators should agree on royalties between parties, so the part of sales from this patent), and provide the legal right to sell it for economic profit. IP rights are the tool to improve a company's competitiveness and become innovative in the market (Ernst 2001). Patents contribute as one of the performance indicators to measure an HEI's academic performance.

Di Gregorio and Shane (2003) was found that the core factors of excellent efficiency of TTP performance are: orientation to research, unique intellectual property and strength of the TTO personnel. Based on the importance of HEIs intellectual property and possible economic profit, patent applications were selected as the most valuable HEIs selection indicator for the research in this chapter.

The conducted study provides the understanding of research efficiency in HEIs, identifies the main performance drivers and allows improving the allocation of HEIs financial and human resources, orienting HEIs for the more effective research activities. The tool to measure the efficiency of the TT process in Lithuanian HEIs was proposed and applied in the chapter. Thus, the goal of this chapter is to measure the efficiency of TT process performance in Lithuanian HEIs. Estimated objectives are (1) to perform the literature analysis of TT and valorisation aspects and DEA tool; (2) to set out the inputs and outputs criteria for mathematical modelling; (3) to gather the data and prepare the database for measurement of efficiency of HEIs with DEA tool; (4) to perform empirical research with linear programming DEAFrontier software and calculate the efficiency of Lithuanian HEIs; (5) to evaluate and finalise obtained results.

This research work is organised as follows. The first section provides the theoretical base for the TT and valorisation process at HEIs and the performance value for results. The second section is intended for methodology description when the third part represents the framework to measure the efficiency of TT process performance of Lithuanian HEIs: data, criteria used, empirical analysis and research findings. The chapter is finished with conclusions and discussions.

2 Theoretical Study: Technology Transfer and Valorisation Activity to Accelerate HEIs Performance

The results of TT and valorisation processes show the level of efficiency and abilities of HEIs to implement industry-university commercialisation activities. In other words, the performance of TT and valorisation activities shows entrepreneurial matchmaking between idea's authors, TT staff and industry players. The main actors in TT and valorisation activities in HEIs are scientists, administration human resources (especially heads), TT and valorisation staff, industry representatives, country's government. A significant role here acts the government with its strategy and financing policy for innovation and scientific activities asking for modernisation of technology transfer activities (Choudhry and Ponzio 2020). Kiškienė (2009) had identified, that clear policy at the country has a direct influence on the TT and valorisation model. Challenging situation met in Lithuania with unclear policy relating TT and valorisation at universities. Every HEI has the right to approve their own rules for managing IP at universities. The mentioned step is leading by HEIs heads, who have a crucial influence on the strategy and policy developing TT and valorisation activities inside universities. Only leadership could drive the institutions and influence the performance of HEIs. Such kind leaders understand the importance of TT and valorisation staff to get a high return from commercialised research and development (R&D) products. TT ecosystem, entrepreneurial universities, university-industry collaboration are considered in several research works (McAdam and Debackere 2017; Baglieri et al. 2018; Good et al. 2018; Ankrah and Al-Tabbaa 2015; Azagra-Caro et al. 2017; Croce et al. 2014; Fini et al. 2018; Hayter et al. 2018a, b; Hayter and Rooksby 2016; Huyghe et al. 2016; Munari et al. 2016; Steinmo and Rasmussen 2016; Günsel et al. 2018; Abbas et al. 2018; Qian and Jung 2017; Miranda et al. 2018; Silva et al. 2020).

During every HEIs yearly evaluation stage on results, heads of institutions should rethink their policy and make decisions on improving it for the next year. It is similar to the innovation concept, which states that innovation—it is not about the product; it is about the process. The next model should be considered before designing a new product now. Innovation process means thinking of several steps in front of today. This strategy ensures regular increased performance results for the organisation.

Moreover, other authors add, that not only production of R&D, but also the competitiveness of the region and university dissemination works all together have the strong effect on TT and valorisation process activities for every entrepreneurial organisation (Audretsch et al. 2012; Schaeffer et al. 2020). Decter et al. (2007) have analysed the case of America and the United Kingdom, and they pointed significant factors for TT process: country policy on TT, motivation tools and accessibility of HEIs cutting-edge technologies and know-how for outside business companies.

Meanwhile, Gold et al. (2001) distinguished further critical criteria and capabilities: technology and protection, culture and knowledge in TT process, structure, ability to change and take on decisions. Other authors found that technology inventor (creator) is one of the essential persons playing a crucial role in the successful

transfer of innovations. Research results showed that about 50% of TT cases were completed by the inventor (Feng et al. 2012).

Even Clark and Bruno-Jofre (2000) have deployed the element for entrepreneurial success—establishing administrative divisions on an organisational level as TTVO for symbiotic TT relationship between managers and academic staff.

Every HEI converts its capacity into results using available resources to get estimated outcomes and outputs. University TTVOs fulfil the industrial-academic gap. Mentioned structural departments connect HEIs and industry to stimulate commercialisation activities. The primary function of TTVO is to moderate the relationship between HEIs staff (researchers, scientists, other) and outside stakeholders as interested industry companies, venture capitalists, business angels, startup's accelerators, etc. Excellent communication stands here essential ability for TTVO and directly influences industry-academic partnership that converts into fees and royalties earned through commercialisation actions of HEIs IP. Technology marketing is also performing by TTVO and demonstrates success during the dissemination of research results (Lee 2020; Rood 2018).

What are the main performance indicators to measure HEIs performance results?

Based on the literature, TT process of HEIs could be measured by such indicators as (1) funding (per one researcher); (2) the number of students; (3) the number of publications (per researcher and year); (4) the number of startups (Hulsbeck et al. 2011). Taking into account the case of Lithuania, the collection of data for first, third and fourth indicators would be complicated because these data are differently interpreting in universities rectors' reports (the methodology for calculation of indicators is not provided for public). Hulsbeck et al. (2011) also foreseen next performance indicators of TTVO: the number of employees (in full-time equivalent—FTE), the number of tasks (per employee), the number of researchers with PhD degree (Hulsbeck et al. 2011). Araujo and Teixeira (2014) was highlighted vital aspects and the main elements of TT: human capital (technical capabilities, training, human capital); absorptive capacity (absorptive capacity implying the ability of the industry to use contemporary technologies); connectedness (communication, relationship, social connectedness what is the essential factor for universities TTVO); trust (trust); experience (past and prior experience, number of partners, foreign experience, especially with universities from abroad); size (organisation's size); sector (the sector). Therefore, this is evidence that international relations of HEIs have a direct impact on TT performance results. Also typically, such inputs are identified as the number of research staff, materials, budget, infrastructure, and others, when outputs found scientific production, teaching quality, and graduation rates, other. The selection of inputs and outputs criteria for efficiency evaluation is challenging and depends on the context of the evaluation field. There is no specific rule and right answer how to select input and output criteria. The selection process might be complicated, when, for example, the number of publications is easy to obtain, the quality of publications is very challenging (Munoz 2016).

Analysis of Lithuanian HEIs rectors' reports relies on several essential criteria of performance as contract works (sponsored research), national and international projects. Licensing is not such a popular way of commercialisation in Lithuania,

and the performance is deficient. Taking into account this aspect, licensing results are not involved in the calculations in this chapter.

Kiškienė (2009) have provided empirical evidence that the Lithuanian market is insufficient on the context of TT. It is reflected on unsuccessful performance, which is also influenced by insufficient the management of scientific knowledge and IP at HEIs. The reason is the lack of experience in managing and commercialisation of science production, when TTVO were established not long time ago, just before around 5 years. Every year Lithuanian Government always requires better results raised from HEIs. This is the point of view when the university is treated as an industrial company for the mission of earning money. Government is enforcing HEIs to increase the return of public investment and become more independent. It leads HEIs to foster entrepreneurial culture inside universities and invest in TTVO staff professional abilities. In 2009 Lithuanian government was recommended to approve the policy of IP management at HEIs and prepare the specific package of legal documents to manage IP inside HEIs (disclosure rules, protection of IP, evaluation procedure, commercialisation, starting the rules on patenting issues, licensing, selling, starting young startup companies, stocks, sharing the profit between parties, other). This is the first step to provoke HEIs for commercialisation of IP. Therefore, good practice from abroad (for example Stanford) shows that, unfortunately, good commercialisation results of HEIs TTVOs come after at least 10 years period of time, following intensive work with the surrounding environment and all related stakeholders (staff, industry, government, etc.). Building a thriving startup community at HEIs brings good result from entrepreneurial activities. Since the 1970s, Silicon Valley started to grow the culture of developing young perspective companies. The great examples are Facebook, Twitter, or LinkedIn, which were born there. Next key players of creation startup community are government, HEIs, investors, mentors, service providers, and large companies, which all together help in developing young perspective companies.

TTVOs commercialisation action might be to license university IP to startups. The royalties, a lack of licensing and contracting practice of IP protection, could inhibit innovations (Feld 2012). The number of university-based startups in Lithuanian HEIs is deficient, so this indicator is not involved in the research. Massachusetts (MIT) is the region, where biotechnology cluster exists, and supplies of investment capital (investors), executive talent, trained researchers and support actors: accountants, lawyers, real estate professionals helping to establish companies. Alumni of MIT form around 40% of the high-technology spin-offs. The students have the leadership skills, self-confident and are responsible for taking risks (failure is a learning opportunity—not a black mark"). The culture in MIT leads to thinking in the way of "I can do it too". MIT model for starting up startups is dependent on a mature, and entrepreneurial community surrounding HEIs. The legal, relatively non-bureaucratic infrastructure must be created to reach success. Formation of startups and development of clusters requires talent: world-class researchers; trained and talented TT professionals; entrepreneurial founders of company; staff with scientists and managers for the companies; knowledgeable investors to fund and guide as well the company, and support staff professionals (Nelsen 2005).

These days Lithuanian universities are just on the way of forming entrepreneurial ground within universities and train TTVO science managers to get successful results from public-private collaboration. Link et al. (2008) have stated, that academics are driven by academic recognition, that they could get quickly publishing the results of R&D activities, while the industry has the opposite thought: to gather ideas and disseminate only after the decision of presenting new products or services for customers.

3 Research Methodology

The research methodology is based on the efficiency evaluation approach—Data envelopment analysis (DEA) tool to measure the efficiency and evaluate the relative performance of a set of institutions referred as decision-making units (DMUs) leading with their multiple inputs and outputs. In this sense, the key advantages of DEA are that it can calculate the efficiency metric for a single institution combining multiple inputs and outputs (Munoz 2016). DEA is a tool for relative evaluation of individual efficiency or the tool for evaluating the performance of DMU within the estimated target group of interest, and acting in a particular field of activity as banking, healthcare, agriculture industry, education (including higher education) sector, etc. DMU can be equated to production units. DEA is the instrument, which helps to identify sources of inefficiency, evaluate management (to benchmark manufacturing and service operations), rank the DMUs, evaluate the efficiency of regions in the country, environmental productivity, banks, universities' productivity, policies or programs, resources on the quantitative basis and reallocate them, emissions efficiency, energy efficiency, etc. (Çalik et al. 2018; Chodakowska and Nazarko 2017; Radojicic et al. 2018; Wolszczak-Derlacz 2018; Liu et al. 2013; Wang et al. 2013; Zhang and Choi 2013; Zhang et al. 2013). In general, existing several DEA models are calculating the relative efficiency, which is relative to similar companies, universities, banks or other DMUs in the sample. The original DEA model was created by American economists Charnes, Cooper and Rhodes and widely used in efficiency analysis (Charnes et al. 1978, 1981; Feruś 2008). DEA is input-output oriented (the ratio of outputs to inputs) frontier-based linear mathematical programming-based approach, which could be used for multiple-criteria evaluation of DMUs as alternatives with own performances (inputs and outputs) (Cook et al. 2014).

In the case of the inversion of this model, we would get the output-oriented minimisation model (Fig. 2). However, in this chapter, we will analyse the input-oriented model (Cook et al. 2014).

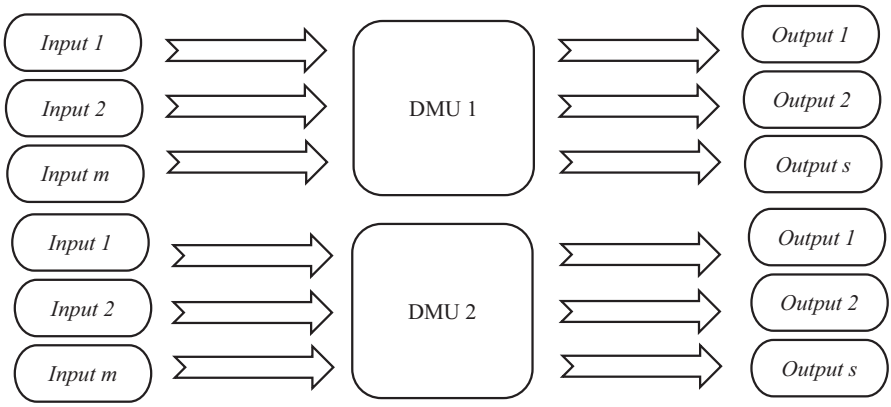

Fig. 2 The outline of the DEA model (compiled by authors adapted from Feruś 2008)

4 DEA Tool to Assess the Performance of an Activity

DEA model is based on the ratio of output and input. DEA is useful for policymakers of any institution or country to provide the model to assist in prioritising actions to improve the efficiency of their own decisions in the most efficient possible ways. This approach is creating common weights referring to the non-inferior solution set, instead of from a single DMU point. The application did not require the predetermination of weights for every DMU (Velasquez and Hester 2013). Hence, the DEA method is calculating the efficiency of a particular variable (DMU) concerning all other variables (DMUs) from a homogenous group. Effective variables (DMUs) within a homogenous group make a production frontier (efficiency curve).

Meanwhile, the efficiency of other homogenous variables (DMUs) is calculated concerning the efficiency curve, which is founded by solving a linear programming issue (DEA method). For those DMUs which are close to the efficiency curve, the coefficient of efficiency is equal to 1. Moving forward, the DMUs located below the efficiency frontier have efficiency less than 1. Moreover, this scenario is quite enough indication for the level of technical efficiency (Feruś 2008). In other words, DEA evaluates observed data of non-frontier DMUs and the level of efficiency, which is relative to a non-parametric, maximum possibility estimate of the actual frontier which is unobserved (Simar and Wilson 2007).

Data selection should be clearly defined. Moving forward, the first concern met is in setting outperformance results into inputs and outputs, which should be selected. In some cases, inputs and outputs could be the same performance indicator. As an example, PhD students at universities in one case could act the role of output (as outcome), in another case—input, when we treat PhD students as a resource in the scientific production process. So, inputs and outputs should be selected by the author and substantiated by the reasons of choosing in this way. DEA approach could evaluate the services, as the satisfaction of students (as outputs), when inputs

could be such measures as resources expended by DMU. The clearest inputs and outputs are in the process of production. The sense should be pointed out here, that DEA method minimises input and maximises output criteria (Cook et al. 2014).

DEA—multiple-criteria evaluation methodology, where multiple criteria are modelled in the form of ratio system, as an example—CCR ratio model, when there are no slacks (excess in inputs, and shortfalls in outputs) in any optimal solution when the efficiency is equal to one (Cook et al. 2014). It is preconditioned that each DMU contains at least one input and one output (Feruś 2008).

$$\begin{gathered} \text{Maximum } e_{j_0}, \\ \text{Subject to}: e_j < 1 \\ \text{where}, e_j = \frac{\sum_{r=1}^{s} u_r y_{rj}}{\sum_{i=1}^{m} v_i x_{ij}} \end{gathered} \tag{1}$$

Here, x_{ij}—DEA inputs, and y_{rj}—DEA outputs, v_i and u_r—unknown weights. For a simple understanding, e_j—is the ratio of benefit and cost (Cook and Seiford 2009).

Next peculiarity is to fix the number of DMUs. DEA model invokes a rule, that the number of DMUs should be at least twice less than the number of inputs and outputs combined (Cook et al. 2014). While Banker et al. (1989) state that the number of DMUs should be at least three times greater than the number of inputs and outputs. This role more used for convenience, than based on imperative or statistical base. Formula (1) is intended for minimisation of inverse ratio ($1/e_{j_0}$), and it is the output-oriented model when a change of orientation still is the same. However, such a transformation does not imply a change of direction.

Farrell (1957) was the first who introduced the study of the efficient frontier, which suggested a simple measure of the efficiency of the organisation. The model consists of two stages: technical and allocative evaluation of efficiency. The technical efficiency was described as an organisation's ability to produce maximum output from several inputs. Allocative efficiency was described as the organisation's ability to use inputs in an optimal proportion by respective prices. Farell named this process as cost efficiency (Palecková 2016).

Two scale assumptions are typically used in DEA: variable returns to scale (VRS) and constant returns to scale (CRS) (Munoz 2016). CCR model (Charnes et al. 1978), named of its creators by the study Charnes, Cooper and Rhodes, becomes constant returns to scale (CRS) (Palecková 2016). CRS model assumes that there is no relation between the efficiency and scale of operation (the size of the DMU) (Munoz 2016). The ratio forms of DEA model—CCR ratio model is based on proportional reduction (or increase) of input (or output) vectors without slacks (Cook et al. 2014). Later on, Banker et al. (1984) had modified CCR model of the variable returns to scale (VRS) and name it as BCC model (created by Banker, Charnes and Cooper), which assumes that there is a significant correlation between the efficiency and the size of the same DMU (Palecková 2016; Munoz 2016). BCC model (based on proportional reduction of input vectors without slacks) eliminates

the measures of inefficiencies caused by inadequate DMU size. The presumption of variable returns to scale (VRS) provides a measurement of absolute technical efficiency, and this implies the lack of scale efficiency impact (Palecková 2016). CRS and VRS efficiency are the constructs of radial projection (Cook et al. 2014). BCC model was selected for the research because we assume, that there is a significant correlation between HEI size and its efficiency, and every HEI will be evaluated separately in the homogenous group of DMUs.

BCC model, with its production frontiers, looks like the convex body of the existing DMUs.

The productivity of DMUs with VRS model is expressed by the ratio of outputs-to-inputs (Cook and Seiford 2009). The efficiency of those DMUs, which are under the Frontier efficiency line, means ineffective results (Feruś 2008).

Applying the BCC ratio model (Cook and Seiford 2009):

$$e_0^* = \max\left[\sum_r u_r y_{ro} - u_0\right] / \sum_i v_i x_{io.}$$

$$\text{Subject to}: \sum_r u_r y_{rj} - u_o - \sum_i v_i x_{ij} \le 0, when\ j = 1,\ldots,n \tag{2}$$

$$u_r \ge \varepsilon, v_i \ge \varepsilon, \forall i, r$$

u_0 unrestricted in sign.

Where: ε—is a non-archimedean value to keep strict positivity of variables; j—each DMU; m—the number of inputs x_{ij} ($i = 1, \ldots, m$); s—amount of outputs y_{rj} ($r = 1, \ldots, s$); u and v—are weights (Cook and Seiford 2009).

The linear programming method (input-oriented model) (Cook and Seiford 2009):

$$e_0^* = \max \sum_r \mu_r y_0 - \mu_0$$

$$\text{Subject to}: \sum_i v_i x_{i0} = 1$$

$$\sum_r \mu_r y_{rj} - \mu_0 - \sum_i v_i x_{ij} \le 0; j = 1,\ldots,n; \tag{3}$$

$$\mu_r \ge \varepsilon, v_i \ge \varepsilon; \forall i, r$$

In this method, μ_0—unrestricted weight, and variables $\mu_r = tu_r$; t—shows transposition; $t = (\sum_i v_i x_{io})^{-1}$ (Cook and Seiford 2009).

Based on the research of the University of Connecticut working papers comparing input- and output-oriented DEA models measuring technical efficiency on the case of production was found that input-oriented technical efficiency is more significant than output-oriented. The organisation would need to increase their output scale with a purpose to attain the most productive scale result when input inefficiency is eliminated. Similar situation with the output-oriented model: when output-efficiency is higher, the organisation needs to scale down when output inefficiency is eliminated (Ray 2008).

Input-oriented technical efficiency model means to produce a given set of outputs taking the smallest linear function of several inputs. Input orientation means organisation willingness to be efficient when it is not possible to raise any of existing input levels without increasing at least another one of input levels and (or) without lowering of at least one of organisation's output levels (Marques and De Witte 2011).

As we see, the theory says that the input-oriented model is seeking to maximise outputs during minimising inputs. Therefore, concerning the input-oriented model, the goal is to seek the most rational use of inputs, and in that way, the organisation can reach the maximum outputs. In our study, we are seeking to use resources (inputs) most efficiently. Thus, HEI to be effective should increase the efficiency of resources (inputs) and use them to maximise outputs. In the case of selected variables for the research, the more effective we utilise financial resources from international projects, contract and research works, the more efficient results from doctorates, masters and researchers we will get, as well as the cost of achieving a unit decrease.

Potential problem during the selection of indicators for DEA is that the raw data (the number of employees, revenues, profits, assets, etc.) and ratios (as returns on investment and profit per employee) could not be used in the one model. From the other hand, a mixture of percentiles, ratios, and raw data is permissible in one measurement of the efficiency with the DEA tool. For example, two inputs selected are: the number of employees (p_i), and the total average employees' salary (c_i), when the output is chosen is annual average sales (d_i) produced by the employee. DEA is calculated: $u_i(d_i/p_i)/(v_i(c_i/p_i) + v_2p_i)$, where u_1, $v_{1,}v_2$ are weights. Latter ratio is equivalentto $u_1 d_i / \left(v_1 c_i + v_2 p_i^2\right)$. Here we see that the bigger attention is dedicated to thenumber of employees, by squaring it, while all the rest indicators are evaluated in the linear principle. This example shows that when a factor (in this case—the number of employees) exist between factors of both inputs and outputs, then the joint problem could occur in not proper mixing raw data with ratio ones. However, research papers do not provide a clear justification for this issue (Cook et al. 2014).

Moreover, the issues with indicators may also arise in the CRS model. If the indicator (or factor) value is the same at all chosen DMUs, when one input (in CRS model—output-oriented) or one output (in CRS model—input-oriented) has the same value at all DMUs, the CRS model becomes VRS (variable returns to scale) model. The reason for that is because input or output constraint turns to the convexity constraint within the CRS model. Another peculiarity is that if the indicators of the VRS model are in percentages (the ratio data), then the DEA projections will be in the normal range from 0% till 100%. However, in the constant returns to scale (CRS) model (output-oriented), the projection of output indicators can reach more than 100%. Therefore, take it into the mind when using a CRS model (Cook et al. 2014).

There are some issues also with the selection of criteria for inputs outputs. There is no right role on how to select the indicators. In some papers, such indicators are selected for evaluation of the research results. For inputs: expenditures of HEI, number of research staff, number of research students, research grants, other, when for the outputs are selected: number of graduates of research, number of publications,

number of awards, number of intellectual properties (Kuah and Wong 2011). Nazarko and Šaparauskas (2014) were identified next inputs for evaluation of public higher education institutions: government budget subsidy, number of academic teachers, number of other employees, number of licenses to award PhD degrees, number of licenses to award higher doctorate degrees; outputs: full-time students, full-time PhD students, percentage of students studying abroad, percentage of international students, percentage of students with university scholarships, percentage of students with government ministry scholarships, employer preference for hiring alumni, other. The selection of concrete inputs and outputs for the research is presented in section three.

5 DEA Framework to Measure HEIs Efficiency of Technology Transfer (TT) Process Performance

With the purpose to explain the steps of DEA framework, proposed model to measure HEIs efficiency of TT process performance is: 1) to select the research sample; 2) to select inputs and outputs criteria; 3) to apply input-oriented linear programming DEA tool for modelling HEIs efficiency of technology transfer (TT) process performance; 4) to perform a comparative analysis of HEIs efficiency after applying DEA tool.

Step 1. Selection of research sample. Due to the homogeneity of the data set, seven Lithuanian HEIs, which have TT process performance results, are analysed and included in this research. Being more specific, it has been selected those HEIs which have the practice in the creation of intellectual property. The patent applications are proposed as the main performance measure of TT activities of HEIs in Lithuania. Detailed statistics of national patent applications of Lithuanian HEIs are provided by Lithuanian National Patent Office every year. In the case of this research, it was selected those HEIs, which have at least one patent application during, that is why only seven universities in Lithuania were taken into the research sample. The more detailed selection process is presented in a previous publication (Stankevičienė et al. 2017).

Step 2. Selection of inputs and outputs criteria. DEA is sensitive to the accuracy of data, and therefore, it must be used trustable data sources to ensure the reliable interpretation of the results (Munoz 2016). Thus, the input and output indicators are selected from the official public report of the Lithuanian Research Council. The data for this report was gathered under one methodology (publicly available).

Moreover, in the evaluation process of HEIs science production, independent experts are involved. Therefore, the evaluation is double-checked, which gives confidence in the evaluation process. The logic of indicators' selection was designed in that way: yearly results of 2 years (2013 and 2014) of inputs create 2-yearly results of 2015 and 2016 outputs. The data for the mentioned period was used due to the actual latest data available from the official data of the Research Council of

Lithuania (The Research Council of Lithuania 2015). The data of master and PhD students' places were selected from the official data source—Lithuania commandment of the Minister of Science and Education (Order of the Ministry of Education and Science of the Republic of Lithuania 2012, 2013, 2014). The public data is available unfortunately quite late after the end of the extended science performance evaluation process, implemented by the Research Council of Lithuania.

Due to DEA pitfall on the number of indicators in relation to the number of DMUs, it was selected three inputs, and three outputs to measure the efficiency of TT performance of seven Lithuanian HEIs. For this research are identified these TT performance indicators: $S_i(TPP)$—the number of financial resources received by HEI during participation in international research projects; $S_i(USU)$—the number of financial resources received by HEI during the implementation of research and experimental (social, cultural) development science works with industry; PLE_i—full-time equivalent (FTE) of HEI's scientists (artists); ds_i—the number of declarative science jobs in a particular field.

For the inputs are identified these three indicators: $S_i(TPP)$ (in 1), $S_i(USU)$ (in 2), ds_i (in 3), meanwhile for the outputs are identified next ones: PLE_i (out 1), the number of *PhD* students (out 2), the number of *Master* students (out 3). The data for the indicators of $S_i(TPP)$, $S_i(USU)$, ds_i, PLE_i was used from the official public report implemented by the Research Council of Lithuania and intended to evaluate Lithuanian HEIs by science-business performance results. When the number of *PhD* and *Masters* students was gathered from the document (Order of the Ministry of Education and Science of the Republic of Lithuania. 2012, 2013, 2014). However, in this chapter, the logic is based on the methodology approved by the Lithuanian Research Council for funding HEIs, when the financial resources from the government are providing based on the science performance results. Thus, the results of 2 years bring us the funding for the next 2 years: earned money from the research and science works brings us the possibility to have several scientists in FTE and young researchers (masters, doctorates) for ensuring the future of science production. On the other hand, the money from international projects or works with industry, as well as the number of science jobs usually come from stimulating commercialisation activities by TTVOs (inputs are chosen) during science-business initiatives. Calculations will be performed in two major fields: social (H, S, M) and physical (P, A, B, T), because of their specific differences on implementation of science production.

Step 3. Applying input-oriented linear programming DEA tool for modelling HEIs efficiency of technology transfer (TT) process performance. After the selection of indicators, the DEA method is applied to measure the efficiency of HEIs TT process performance. First of all, the data was collected.

Table 1 represents the data collected to measure the efficiency of the TT process performance of seven Lithuanian universities in the field of physical sciences (P, A, B, T). HEI 2 and HEI 6 are working mostly in the field of physical sciences. Thus we see that HEI 2 2 years results produced the highest number of output 3 (the number of masters), and the similar situation is with HEI 6 and 7. The financial resources of the mentioned HEIs are also the highest. HEI 7 is the biggest university

Table 1 The data of inputs and outputs of Lithuanian HEIs in the field of P, A, B, T (compiled by authors)

	Input 1	Input 2	Input 3	Output 1	Output 2	Output 3
HEI 1	1098.45	1164.51	35.00	146.42	21.00	334.00
HEI 2	11258.22	6932.47	93.00	467.82	102.00	1442.00
HEI 3	1048.43	438.17	31.00	135.39	15.00	148.00
HEI 4	1615.63	1381.11	117.00	537.98	98.00	407.00
HEI 5	0.00	19.36	20.00	16.83	0.00	5.00
HEI 6	352.23	3337.60	81.00	365.94	55.00	1089.00
HEI 7	6097.60	3860.89	215.00	995.69	209.00	1038.00

Table 2 The data of inputs and outputs of Lithuanian HEIs in the field of H, S, M (compiled by authors)

	Input 1	Input 2	Input 3	Output 1	Output 2	Output 3
HEI 1	329.84	28.60	13.00	28.40	2.00	84.00
HEI 2	551.56	280.86	140.00	151.12	22.00	323.00
HEI 3	82.65	972.12	156.00	181.69	15.00	246.00
HEI 4	0.00	0.00	6.00	17.51	0.00	6.00
HEI 5	68.37	354.74	143.00	199.09	61.00	556.00
HEI 6	380.06	38.37	68.00	84.72	10.00	135.00
HEI 7	1247.78	1415.24	251.00	371.58	85.00	1174.00

in Lithuania. The number of FTE (output 1) is more or less relates to the input results (money indicators). Also, the number of students (master and PhD) depends on science production. HEI 5 and HEI 7 are working mostly in the field of social sciences. The biggest number of FTE has HEI 7. It is also conducting science works in the field of physical sciences. In the context of quality we see that university with the highest results of FTE (output 1), the number of PhD (output 2) and Masters (output 3) in turn produce the greatest results of science works (input 3), when generated financial results from the international projects (input 1), contract works (input 2) are depending on the field of the university is conducting the research. During the evaluation of physical sciences field, universities working in the field of social sciences will have lowest results (but still high in comparison with other HEIs) of input one and input 2 (Table 1).

Table 2 represents the data collected to measure the efficiency of the TT process performance of seven Lithuanian universities in the field of social sciences (H, S, M). The insights are quite the same: the number of FTE more or less depends on the input results (the bigger input, the bigger FTE). When the number of PhD and masters students depending on the TT commercialisation results (while raising capital initiatives in university-industry collaboration), produced in money from international projects (input 1), research works with industry (input 2), the number of research works (input 3). HEI 7 is the biggest university in Lithuania acting mostly in the field of social sciences. By analysing HEI 7, we see the quality indicators, when the highest number of staff (output 1 and output 2, together with

output 3) bring the biggest results of input (money from international projects, contract works and science works—input 1, 2 and 3). In turn, HEI 5, working mostly in the field of social sciences are not working quite efficiently having the big number of staff (output 1), that proves low-performance results of HEI 5 from international projects, contract works and science works altogether (input 1, 2 and 3).

Efficiency evaluation of selected HEIs was implemented on the DEAFrontier Free Version used from public open-source using the input-oriented model. The research is based on DEA BCC model when the efficiency of 1 is distributed between all HEIs in the sample. After analysing the situation and universities in different fields we see, that the quality of efficiency is relating also on the field university is acting on and the size of HEI. The big university can be described as the biggest number of students and/or staff having university. In case of Lithuanian universities, HEI 7 is the biggest one, working in the field of social sciences, so the efficiency in the mentioned field is the biggest (36%) when HEI 5—is on the second place (31%). Leadership in the field of physical sciences showed the biggest universities working in the same field: HEI 2 (18%) and HEI 6 (11%). Unfortunately, the biggest university, HEI 7, is also the leader in the field of physical sciences (the reason that HEI 7 also working in the physical sciences field). Summarising, the quality is based on HEIs size representing by FTE efficiently working in the evaluation field.

Step 4. Comparative analysis of HEIs efficiency after applying DEA tool. After carrying out the DEA tool (using envelopment model—BCC without slacks), we see the results in Table 3 and calculated efficiencies of HEIs in two major fields (social and physical). Among analysed seven HEIs, in the field of physical sciences (P, A, B, T) such universities as HEI 7 (37%), HEI 2 (18%) and HEI 6 (11%) have the best results of TT activity. When in the field of social sciences (H, S, M) the leaders of TT are HEI 7 (36%), HEI 5 (31%) and HEI 2 (11%). The worst results deployed HEI 4 (0.2%) in social sciences and HEI 5 (0.1%) in physical sciences. BCC model was checked, and we see that there is a significant relation between HEI size (we can compare the number of FTE—output 1) and its efficiency in the context of TT activity of a homogenous group of DMUs. Therefore, HEI 7 is the most efficient when it has the biggest number of inputs (international projects, contract

Table 3 DEA efficiency results of TT process performance of Lithuanian universities in the field of (P, A, B, T) and (H, S, M) (compiled by authors)

	Objective function	Efficiency		Objective function	Efficiency
	P, A, B, T	*P, A, B, T* (%)		*H, S, M*	*H, S, M* (%)
HEI 7	0.093	37	HEI 7	0.264	36
HEI 2	0.215	18	HEI 5	4.824	31
HEI 6	1.000	11	HEI 2	0.598	11
HEI 4	0.171	9	HEI 3	3.991	10
HEI 3	0.187	5	HEI 6	0.868	8
HEI 1	0.571	4	HEI 1	1.000	3
HEI 5	1.000	0.1	HEI 4	2.167	0.2

works and science works) what produced the biggest number of researchers in FTE, doctorates and master students in outputs in comparison with other HEIs in the sample. The inputs and outputs were selected based on the DEA model specific and limitations when the number of inputs as well as the number of outputs should be at least twice times less than the number of DMUs (in our case—HEIs) as a homogenous group in the research. Due to the fact, that the greatest results coming from TT and commercialisation process (as the result of efficient work of TTO staff in collaboration with HEIs researchers producing intellectual property for HEIs) bring the stronger possibilities for HEIs in the future to employ more research and administrative staff in FTE, and in that way have young students (masters and doctorates), who are the future of HEIs as the new perspective researchers, active during participating in collaboration activities with industry, initiating new research projects, contract works, preparing scientific articles as science production for HEI, what is valuable for HEI ensuring the most significant funding coming from the government every year. The literature analysis shows that the researcher has at least half success rate in collaboration with industry (outside world). Therefore, it should be taken into account. The conducted research of Lithuanian universities and obtained results in this chapter show that the current efficiency level of analysed TTP in investigated HEIs in the sample differs. To improve the efficiency of TTP, universities should do several steps: to rethink the efficient allocation of human and financial resources necessary for successful development of TTP; to develop or improve current policy and organisational strategy aimed at reform of TTP indicators and economic outputs maximisation; to reorient the existing internal HEI's culture to entrepreneurial and culture of university-business cooperation, which would create favourable conditions to produce industry-oriented R&D. It would lead to higher innovation results of different Lithuanian HEIs and creation of efficiently functioning TT system of the whole country. Research results allow stating that DEA tool is fully applicable for evaluation of the efficiency of HEIs TT process performance.

6 Conclusions and Discussions

The main purpose of this study was achieved, and the tool to measure the efficiency of HEIs TT process performance in Lithuania was developed. The efficiency can be evaluated in different types, but in this study, the methodology fits to evaluate the efficiency in the context of TT in HEIs. The research was identifying benchmark HEIs, comparing their research efficiency among homogenous HEIs, and contrasting individual research efficiency ranking against other typical rankings. Understanding and identifying efficient universities is highly valuable for improved educational policy and reallocation of resources to maximise the impact of scarce resources, especially in scenarios of increasing demand. The assessment of the efficiency of HEIs is relevant for identifying individual performances and make certain decisions

on improvement ways, that result in a positive impact on the whole higher education system.

Literature analysis has deployed the essential aspects relating to TT and valorisation. University-industry partnerships help to encourage TT activities, which are implementing by university TTVOs bringing commercialisation results. TTVOs help to reach a symbiotic balance between HEIs and industry as well as to grow entrepreneurial culture at universities. HEIs performance results depend not only on TTVOs abilities towards commercialisation but also on many other factors: transferrable production of R&D (research capital), technology inventor (creator), academic recognition, competitiveness of the region, university dissemination works (technology marketing), country policy on TT, motivation tools, accessibility of cutting-edge technologies for industry, protection of IP, culture, knowledge in TT process, structure, ability to change and take on decisions, communication skills.

DEA plays the role of a technique to support decision-makers taking decisions in the field of higher education. DEA tool as the input-output oriented frontier-based linear mathematical programming-based approach was selected to measure the efficiency of HEIs (DMUs) TT process performance as more effective in comparison with the output-oriented model. DEA main advantage is that it provides a single efficiency result that incorporates multiple inputs and outputs. DEA results would be applied as the roadmap of data for better use of resources of HEIs. In several research papers, the DEA model is selecting for evaluation of the efficiency of a target group of interest in such fields as banking, healthcare, energy, agriculture industry, education sector, etc. The latter sector has chosen for the research. The process of selecting inputs and outputs are quite challenging. In this chapter, the principle of criteria selection: the results of 2 years bring the funding for the next 2 years. Earned money from the research works give the number of scientists (FTE) and young researchers (masters, doctorates), selected as outputs. The profit from international projects or research works with industry, as well as the number of science jobs (inputs) usually influenced by TTVOs through science-business collaboration activities. Intellectual property produced by HEIs researchers is playing an important role in bringing the economic benefit from commercialised patents. A patent application has been selected as the most important indicator to identify HEIs for the research sample. Only seven Lithuanian HEIs have at least one patent application in comparison with all rest universities in Lithuania. Calculations were performing in relation with TT criteria (international research projects, research works with industry, the number of research works) in two major fields due to specific of different fields of science: social (H, S, M) and physical (P, A, B, T).

The data for DEA tool must be trustable to ensure the reliable interpretation of the individual results of HEIs. Therefore, the input and output indicators were selected from the official public report of Lithuanian Research Council and from the commandment of the head of the Ministry of Education and Science: the yearly data was gathered. Thus, the framework for efficiency evaluation was created from a homogenous group of seven Lithuanian HEIs, which have TT performance results, at least one patent application, and the next criteria for the research. Inputs: (1) international research projects (money); (2) contract research (money); (3) the

number of research works in the field (number). Outputs: (1) full-time equivalent (FTE) of research staff (coefficient); (2) the number of *PhD* students (number); (3) the number of *Master* students (number). The data was calculated in two major fields: physical (P, A, B, T) and social (H, S, M).

By solving linear programming issue with DEAFrontier Free Version tool, the efficiency of homogenous variables was calculated. Thus, HEIs individual performance results were obtained: in the field of physical sciences (P, A, B, T) HEI 7 showed the best results (37%), HEI 2—second by performance results (18%), and HEI 6—the third (11%). Performance results in social sciences showed following DMUs: the best performance—HEI 7 (36%), while on the second place—HEI 5 (31%), and the third is HEI 2 (11%). The efficiency of about 30% is not enough, so Lithuanian HEIs should take on innovative decisions (changing in structure, policies, management, other) for future improvement. The worst performance results have deployed HEI 4 (0.2%) in social sciences, and HEI 5 (only 0.1%) in physical. BCC model was used, and we see that there is a significant relation between HEI size and efficiency in the context of a homogenous group of DMUs. We know that the more significant results from TT and commercialisation process gives the stronger possibilities for HEIs to employ more staff in FTE (output 1), and have more young students (masters—output 2, and doctorates—output 3). They are the future of HEIs as the new spillovers to work with industry, produce ideas for research activities. The number of PhD and masters students depend on the TT commercialisation results (while raising capital initiatives in university-industry collaboration), produced in money from international projects (input 1), research works with industry (input 2), the number of research works (input 3). The literature analysis shows that the researcher has at least half success rate in collaboration with industry (outside world). Therefore, it is necessary for TT performance. Input-oriented model is seeking to maximise outputs through minimising inputs. Therefore, HEIs should seek the most rational use of inputs and in that way to reach the maximum outputs. In our study, we are seeking to use resources (inputs) most efficiently. Thus, HEI to be effective should increase the efficiency of resources (inputs) and use them to maximise outputs. The more effective we utilise financial resources from international projects, contract and research works, the more efficient results from doctorates, masters and researchers we will get, as well as the cost of achieving a unit decrease. DEA output-oriented model will be used in the future research works to check its efficiency in case of HEIs.

In comparison with other research papers, Kuah and Wong (2011) were used DEA to assess 30 separate HEIs of teaching and research efficiencies by choosing eight inputs and eight outputs, and the model has demonstrated a strong power in differentiating efficient and inefficient HEIs. The comparative efficiency research based on DEA of 19 Polish universities of technology was developed by Nazarko and Šaparauskas (2014), and five input plus eight output criteria, and two environmental criteria were chosen. Analysis of potential variables in recent research was carried out describing the HEI efficiency model, and the relationship between variables to found out (correlation analysis). This is the evidence, that the number of inputs and outputs in this study was selected based on the theory (the

number of HEIs should be at least twice less than the number of inputs and outputs combined (Cook et al. 2014)). The comparative analysis on efficiency may be one of the principal incentives to increase the quality of research and education, to improve the spending efficiency of public funds, to evaluate the current situation and make decisions on the future improvement of financial and human capital allocation as well as to improve the management of HEIs. The results of HEIs efficiency could inform HEIs decision makers about new mechanisms to adapt and achieve the new higher levels of outputs to become more efficient. For future research, it could be interesting to investigate the model for efficient distribution of financial and human resources of HEIs to improve the overall efficiency and bring higher economic value for the country. Also, future research works could analyse what managerial and educational activities enhance the research efficiency of HEIs.

The research results confirm that DEA methodology is an appropriate tool to evaluate the efficiency of the TT process performance of HEIs.

HEIs are playing a significant role in the production of the national capital. Therefore, the public funding of HEIs makes a big part of the overall government budget. Also, the efficiency of HEIs must be prioritised as the essential public challenge and policy to be improved.

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Incentives, Personal Needs, Behavior of the Employees: How Do These Parameters Affect Employees' Productivity, Job Satisfaction and Commitment?

Alexandra Livada and Athanasios Pechlivanidis

Abstract The most important and crucial challenge a manager has to face is how to motivate the employees under his supervision in order to offer the best of their abilities, even under unfavorable conditions. One of the goals of effective organizations is the satisfaction and commitment of their employees.

The purpose of this study is to identify empirically which are the incentives that motivate the employees. For this purpose, a pilot study has been carried out. A sample of Piraeus Bank employees are interviewed in order to reveal which incentives influence two main attitudes: their job commitment and their job satisfaction. Our aim is to find out ways which will help Human Resource Management as well as determinants that describe the alternative ways to improve working performance.

Keywords HR management · Employees' behavior · Incentives · Personal needs · Productivity

1 Introduction

Organizations and companies may spend a lot of money and time for hiring, training and developing employees in order to increase their productivity. An employee is an asset for the company and is not always easy his replacement. This would mean that the company would have to start either thinking on how to secure a recruitment process, which is an expensive one and also a risky one, or how to ensure the com-

A. Livada (✉)
Athens University of Economics and Business, Hellenic Open University, Attiki, Greece
e-mail: livada@aueb.gr

A. Pechlivanidis
Piraeus Bank, Hellenic Open University, Serres, Greece
e-mail: PechlivanidisA@piraeusbank.gr

K. Nermend et al. (eds.), *Decision-Making in Management*, Contributions to Management Science, https://doi.org/10.1007/978-3-030-67020-7_16

mitment of its employees and therefore their retention (Cleveland and Hash 2002). When a company loses employees, it also loses their skills and their experience. This affects company's productivity and profitability and at the same time there is a negative effect to the employee's relationships. Thus, is very important to explore ways a firm may follow in order to secure the job position of its employees and their commitment.

According to Cleveland and Hash (2002) the replacement of an employee is expensive due to the: direct costs (for recruiting new employee), opportunity costs (due to loss sales and decreased productivity) and indirect costs (due to loss of knowledge, reduced morale and decrease of the company growth). In addition, Luecke (2003) describes that the retention of good employees matters for two more reasons: Firstly, the importance of intellectual property: when an employee leaves for a competitor, he transfers his knowledge, and this leads the competitor to get the knowledge without having to invest the same time and money. Secondly, there is a link between employee tenure and customer satisfaction: in general satisfied employees both with their work and their company is more possible to satisfy the customers as well. On the other hand, negative behaviors affect customers' satisfaction.

However, there are alternative approaches such a this by Ulrich et al. (1991) who suggested that if a company decreases its turnover, this will lead to an increase of the organizational performance and to a cost reduction that is connected with the decreased losses of the firm and lower costs for retraining the employees. Also, the lower employee retention will lead to less indirect costs associated with the lower productivity of the new employees, and for the additional time that is needed for managers and colleagues to support the new employees (Cascio 2000). On the other hand James (1989) also suggests that employee turnover sometimes can be something useful. It keeps salary costs down, it creates opportunities for upward mobility, provides flexibility on stuffing and offer chances for restructuring the organization and also brings new employees to the organization that can offer new ideas and experiences. Meyer and Allen (1991) refer to the "organizational commitment". This stands for having employees who feel attached with the scope and the aims of the firm and they regard the success of the firm as their own success. This also means that the HRM department must study carefully the constructs of organizational commitment to the firm and to focus on how to improve its performance in order to have satisfied employees.

In this study, which is based on Pechlivanidis' A. (Pechlivanidis 2014) master thesis at HOU, we test the organizational commitment in relation with job satisfaction and the incentives given for the case of a Greek bank. More precisely, the topics we are going to test the level of organizational commitment and of job satisfaction of the employees who participate in the survey as well as the incentives can be used so to leverage this personnel. More precisely in Sect. 2 a short review of the literature regarding the employee commitment and job satisfaction is presented. In Sect. 3, statistical analysis and empirical results of the questionnaire data are discussed. Finally, in Sect. 4 a summary and conclusions of the empirical analysis are presented.

2 Review of the Literature on Employee Commitment and Job Satisfaction

2.1 Employees' Commitment

A crucial issue for every organization is to be able to decrease the number of employees who are leaving the firm. Brangam (2005) describes seven reasons that the employees are leaving their company for:

1. The job or workplace was not as expected: It is frequent an employee to go to a new job to face different circumstances than what he expected. In such situation, especially if the things are quite different to what was described during the hire, this drives the employee to mistrust and resentment. Also, it is important the employee to match with the company in terms of expectation. If the employee expects each year to get a promotion and the company is not able to offer that, then there is a mismatch.
2. Mismatch between job and the person: It is important for the employee to fit the job. If the wrong personality for a job is hired this can have negative results for both the employee and the company. If the employee is not excited when first assigned to a job and complaints about the job content, this is not a positive situation. Also, the same happens when employees' results are lower to what expected or when he makes many mistakes.
3. Too little coaching and feedback: There is sometimes a wrong approach from supervisors and managers that the top performers of a company can be set loose. Even the top performers need feedback and coaching, because this builds competence, hope and trust. This helps building a relationship between the employee and his supervisor or manager.
4. Few growth and advancement opportunities: It is really important for the employee to feel that he has development opportunities. They need opportunities and they are not going to stay for very long if they do not feel that their managers are not interested for their development. Also, unfairness or favoritism in promotion decisions may cause an employee to decide to leave his company. The company should offer the chances to the employee to create systems and policies for their growth.
5. Feeling devalued and unrecognized: It is very important for the employee to get recognition, they need it and they appreciate it. The employees must be treated with kindness and politeness. If these do not exist, they will prefer to change job. The least competent employees and the ones that fear that they cannot get a new job are the ones that will continue to work in such circumstances. A nice working environment or the fact that the employee has the right tools to work can show to the employee that the company is interested about him. The most emotional issue of all usually is what the company pays for their contribution.
6. Stress from overwork and work-life imbalance: in the current hyper competitive global economy the companies try to squeeze as much productivity from their

employees as the can. Brangam (2005) characterizes toxic a company culture that force workers to choose between having a life or a career, that does not have a long-term strategy and when the leaders are not in touch with employee feelings and attitude.

7. Loss of trust and confidence in senior leaders: when leaders do not provide a clear vision, and are not understandable and it is hard for the employees to trust them. They should not be unethical or narcissistic.

It is very crucial for firms to find an antidote on all of the above mentioned reasons which lead important part of its personnel and human capital to leave. This can be done with the strengthening of the reasons which lead the employees to feel committed with the firm and hence to increase employee commitment with the firm.

The concept of organizational commitment has risen during the past years with a number of papers which analyze the reasons which lead to the commitment and the engagement of the employee with the firm that he/she works. Work commitment has been analyzed from different and often interrelated views. An early work was done from Kahn (1990) who referred on the personal engagement of the employee to the workplace that he works. This means that the employee would like to express, on different ways based on his personality, his commitment to the work. This can be done with superior work performance, physically positive presence in the work or any other factor which shows that this person is delighted from his work and he would like to increase his share of contribution. Kahn (1990) has also mentioned three conditions which lead into the individual's commitment to his employer. Those are the safety, the availability and the meaningfulness. May et al. (2004) has added that those three conditions were positive related on job commitment, while they mediated also on the relation of job commitment with other organizational factors.

An interesting piece of work has been done from Maslach et al. (2001). C. Maslach is well known for her work on job burnout. She has also linked job burnout and its effects on job commitment. Maslach et al. (2001) found that there was an antithesis between job burnout and work commitment. There are three dimensions of burnout; emotional exhaustion, lack of self-efficacy and lack of praising the individual's effort for the firm. However, a person who has a high degree of commitment to this work is expected to have high levels of involvement, good spirit and a sense that his work has been accomplished and praised from the top management of the firm. Schaufeli et al. (2002) have mentioned that job burnout is an opposite meaning of job commitment and engagement to the organization that the individual works for.

Schaufeli et al. (2002) has mentioned that work commitment is the status where the individual is in a positive status in relation with this work. This means that the individual person has developed positive stances and perceptions over his work and his relation with the firm. Job commitment is characterized from dedication and vigor to the employer. The individual shows a willingness to invest his efforts, skills, knowledge and even to sacrifice something else, such as some of his free time, to his employer. Another fact is that someone who is committed to his firm, he will show

his commitment not only during the good times but also during the difficult times of the firm. Adeyemo and Aremu (1999) refer on commitment when an employee considers that the firm that he is working for is part of his vision about the course of his personal career. This means that when an individual is making plans for his future career and he considers that his career will take place and develop within the firm that he is working, and then this is considered as evidence of job commitment.

According to Meyer and Allen (1997) organizational commitment affects HR factors such as organizational turnover, job performance, job burnout, leadership style, job security and many other factors crucial for the performance of the firm. Meyer and Allen (1991) have also linked organizational commitment with job satisfaction and organizational identity. They developed their own model of commitment and its measurement. More precisely, Meyer and Allen (1991) have produced the three-dimension model of organizational commitment. According to their theory, there are three different dimensions which refer on different state of commitment and psychological engagement with the firm. The first dimension is the "affective commitment". At this point the employee has a positive attachment with the organization. The employee seeks to become an important component of the firm. At this point, the employee is part of the firm because he wants to. The second dimension is the continuance commitment, which is the situation where the employee feels committed to the firm because he has to. In this case, the employee expresses his desire to be committed to the firm because he is afraid that he may lose his job or his power if he shows signs of not been committed to the firm. In this case, the employee fears the cost of losing his job. Those include the pension costs, the social cost of losing his co-employees and of course the huge financial cost of losing his monthly wage.. Hence, an employee becomes engaged to the firm not so much because he feels to, but because he wants to protect his own interests. The third dimension is the normative commitment. This is the least part of organizational commitment. The employee feels attached with the organization because he feels obliged to the firm. A typical example is an employee who has taken part on various training and development where the firm has invested a considerable amount of money in order to enhance his knowledge and skills. Under this circumstance the employee feels somehow obliged towards his employer and he wants to show his appreciation with his royalty towards the firm. Meyer and Allen (1997) have remarked that this model has been widely accepted from the academic community but also from practitioners.

2.2 Job Satisfaction

One of the key issues facing the administration of organizations is to measure employee satisfaction. Employee satisfaction is directly linked to good physical and mental health as well as the best performance in the workplace. It should be noted that there is no specific definition of what constitutes job satisfaction. In general, the bases were the work of Locke and defined job satisfaction as a positive situation, ie

a feeling of satisfaction, which feels the employee as a result of the work offered, but also because of the situation and the climate is workplace. In short, job satisfaction means that the worker is in a very good condition and accepts the working environment (Spector 1997). Griffin (2009) makes a number of valuation theories and states that the satisfaction, for example, is defined as an inner state of a worker who is satisfied or dissatisfied with the work experience gained.

In another approach, Abu-Bader (2000) defines job satisfaction as the relationship between the expectations of the employee from the workplace and real wages, which is what generally takes for the work offered. He states that job satisfaction can be divided into intrinsic and extrinsic. The Intrinsic satisfaction refers to the content of the work being performed and how the meet. For example, items such as how solve a task, the autonomy that has the use of his skills are elements that affect the intrinsic satisfaction. On the other hand, extrinsic satisfaction has been used as a reference framework within which the individual works such as industrial relations, working hours, safety, salaries etc.

In conclusion, we see that the satisfaction derived by the person from his work, is actually a behavior which is in direct relation with other important behaviors in the workplace. Generally it can be said that much of the job satisfaction is associated with factors such as work environment, the financial rewards and future trends in the workplace (Griffin 2009).

It must be mentioned that there are some theories linked with job satisfaction. The most prevalent theory today is the theory of influence (Affect Theory) of Edwin A. Locke (1976) (Griffin 2009). Locke is regarded as the father of the theory of job satisfaction. More specifically, suggests that job satisfaction is termed what the worker wants the job and what ultimately takes from it. When he feels that his work is not recognized, then the employee feels that the employer ignores him and disappointed. The Locke (1976) also refers to the fact that each person will evaluate the work of different aspect according to its needs.

It is also the general theory, known as dispositional theory, where the employee has some internal moods. These tendencies determine satisfaction, regardless of the type of work they perform. For example, if an employee is in a bad phase, this will affect the overall satisfaction of the profession (Griffin 2009).

Job satisfaction is also linked with motivation theories. Motivation is one of the basic theories of management. Kant (1998) states that incitement leads the worker to specific behaviors, such as being positive or negative in the workplace. In traditional management incitement is in the form of financial incentives and other incentives such as promotion. Certainly, modern management has progressed much more and has introduced new forms of incentives such as work climate and the proper relationship of work and family responsibilities (work-life balance).

Incitement as an administrative function defined as the process of enabling the skills of workers to achieve the organization's goals (Griffin 2009). Incitement works with the aim to energize, direct and sustain human behavior. To enable staff to work in such a way as to help the organization achieve its objectives, there should be incentives that stimulate professionals to become more productive. Incentives can be financial in nature, since it is known that money activating people to become

more productive, but it can also be socially incentives associated with the effort to create a pleasant working atmosphere, which in turn affects job satisfaction and loyalty to the employee as to the business goals (Griffin 2009).

Significant is the contribution of Maslow (1987) in which his approach on the hierarchical structure of human needs which are distributed as follows: physiological and biological needs, safety requirements, social needs, needs esteem, need for self-actualization. Another approach is the theory of the two factors is the result of personal work of Herzberg is based on the idea that there are factors that create positive emotions in the workplace, and factors that create unpleasant feelings. The address of a company should define, identify the factors that generate positive emotions to use them to motivate its employees (Griffin 2009).

It should be noted that the concept of job satisfaction refers to a posture where the person may have a positive view of the profession. Of course, this means that there may be positive effects such as positive job performance of the employee (Saltzstein et al. 2001). Also, a humanitarian approach tells us that employees who are satisfied with the work shall be in good mental and physical state describing them generally healthy (Crohan et al. 1989).

Conversely, low job satisfaction leads to negative consequences such as poor performance in the workplace and frequent diseases that cause absences from work every day. Also there have been recorded negative consequences in terms of mental well-being of workers. In many cases job dissatisfaction means that the employee will leave the job with negative consequences and costs for the business and for the morale of remaining employees (Trap 1998).

Finally, Burke (2000) states that a relationship exists between organizational behavior, job satisfaction and productivity. The job satisfaction is a result of that practice methods and organizational behavior used by a company. Based on the practices which the employee is satisfied or not and will be judged accordingly and productivity. For Burke (2000) is important to an organization can develop practices such as longer maternity for women who have given birth and better support to employees with health problems to not only improve job satisfaction and performance of employees.

2.3 Commitment, Incentives and Job Satisfaction

Incentive management includes a variety of practices. It can vary from recruitment up to assessment of the personnel. It is very common on HRM to have interrelations between the various activities included on HRM.

One of the most crucial factors linked with job commitment is job satisfaction. Generally speaking, job satisfaction is linked with employees who feel satisfied from their work and they express this situation with a positive stance/behavior towards the organization that they have been working for. Shore and Wagner (1993) have referred on the positive correlation that job satisfaction has on job commitment. Actually it seems that job satisfaction is an important requirement in order to

have job commitment. Hence, based on Shore and Wagner (1993) satisfaction is an indicator of commitment. Martin Jr (1979) describes that job satisfaction decreases with the increase of routine in the work and with the fact that do not exist other job opportunities, but increases with more instrumental communication, which is the information that is transmitted to employees about role performance as signified by on the job training and distributive justice.

Batt et al. (2001) describe that when Human Resource department has high commitment with training, mobility and high relative pay, the employee quit rates are decreased and their commitment increases. On the other hand, when Human Resource department follows cost cutting practices like downsizing, contingent staffing, electronic monitoring and contingent pay, employee retention is increased.

At this point it is important to claim that job satisfaction is a construct of human resource management which is not easy examined. The reason is that each person has different perceptions over what constitutes job satisfaction. For some persons it can be the salary system, for some others it can be the recognition of their efforts, etc. Vinokur et al. (1994) also refers on factors such as the conditions of work (including the workplace climate), corporate culture and other non-monetary motivators which have a significant impact on job satisfaction.

Employee retention is an issue that matters the companies because of the high costs. It requires from the companies to spend resources for replacing employees and not for hiring for growth. Also, this may cause a period that the companies have to work with fewer employees than their needs, something that can cause issues like limited sales or lower market share. Cleveland and Hash (2002) describe that replacing an employee it is expensive, while Luecke (2003) describes that the retention of good employees matters for reasons of competitiveness. Brotheridge and Lee (2005), describe the role of supervisor as central to employee engagement, loyalty and commitment to the company. Supervisor may help to decrease the workplace stress and the behaviors that may lead to employee retention. Also, Tett and Meyer (1993) have researched the relationship between job satisfaction, job retention and employee commitment. They have found that there is clearly a relationship between the two, but this relationship may affect by other factors as unemployment rates. Job satisfaction is related with the engagement of the employees for their job, which describes the fact that they are doing their best and they have a strong sense of psychological ownership for their work outcome (Luthans and Peterson 2002).

Kerr and Slocum (1987) suggest that organizational culture is important and can moderate differences between the commitment rates of weaker and strong performers. There are organizations which culture emphasize to teamwork, security and respect for the individuals. An organization with such values helps employees to improve loyalty and commitment, regardless their performance. On the other hand there are organizations that their culture is connected to the fact that an employee must accomplish his personal work objectives. This type of culture doesn't offer security to the employees and also the employees cannot promise loyalty to the organization. In this type of culture the retention rates may be high for both low and strong performers.

Another important function of HRM is job performance. An early indicator of the link between organizational commitment and job performance has been made from Jackofsky (1984) which indicated that organizational commitment is an indicator of job performance. The survey indicated that when the employees feel that they are engaged and emotionally attached with the scope of the firm, then it is expected that they will increase their performance and therefore the whole organizational performance will benefit from this. Further research has indicated that organizational commitment and job performance are linked and they affected from job security (Darwish 1998), while there is an interrelation between job satisfaction and job commitment where these two variables affect organizational performance (Darwish 2002).

3 Statistical Analysis-Empirical Results

A questionnaire was used for the collection of data in this study. Brown (Brown 2001, p. 6) mentions that self-administered questionnaires have the advantage that they can collect substantial amounts of information in a relatively short time. In order to insure its content validity, the questionnaire was designed by implementing parts of two pre-existing questionnaires and was also based on the relevant literature and studies conducted in the field of job satisfaction and engagement with incentives.

The questionnaire set off with a cover letter which explained the nature of the study as well as assured respondents of anonymity and of the confidentiality of the information provided. Respondents were also given instructions as to how the questionnaire was to be completed and returned. The rationale behind providing clear instructions and assuring confidentiality of information is based on the fact that this significantly reduces the likelihood of obtaining biased responses (Sekaran 2003).

The structure is the following: The introductory part is made from some questions about the demographic profile of the respondents. Questions 1–20 are related with job satisfaction. Questions 20–33 are related with job engagement and motives.

3.1 Questionnaire

The questionnaire has been distributed to 250 persons from Piraeus Bank who work on services where there is a high interaction with the customer. Thus, since we are interested for specific characteristics, we followed random sampling within this specific group of employees (of this specific bank). From those 250 persons, 135 provided a positive feedback. The questionnaires were sent via email, with the help of the HR department, to the personal email of each employee.

The first part of the questionnaire collects demographic information regarding their gender, job position, age and education.

The structure of the second part of the questionnaire is as follows:

Questions	Strongly disagree	Disagree	Neutral	Agree	Strongly agree
1. I am satisfied with my working conditions (working hours, hygienic situation, break time, flexibility in timing, location of the work, etc.)					
2. I am satisfied with the security my job offers me.					
3. I am satisfied with how often I create new ideas, procedures or things.					
4. I am satisfied with how often I take part in problem solving.					
5. I am satisfied with how often I share knowledge with others.					
6. I am satisfied with the amount of resources I have to do my job.					
7. I am satisfied with the opportunities I have to develop skills that interest me.					
8. I am satisfied with the amount of time I have to do my job.					
9. I am satisfied with the amount of training I get.					
10. I am satisfied with my current position					
11. My supervisor is a fair and reasonable person.					
12. My supervisor has adequate knowledge to make decisions about my job.					
13. I am paid fairly for the work I do.					
14. In my organization, job promotions are fair and objective.					
15. My coworkers respect each other‘s opinions and values.					
16. My job uses my best abilities.					
17. My company’s policies and procedures are clearly communicated.					
18. My company’s policies and procedures create an effective work environment.					
19. I have sufficient opportunities for professional growth.					
20. I am satisfied I work in a dynamic company.					
21. I am completely focused on my job duties.					
22. I am determined to give my best effort at work each day.					
23. I am determined to accomplish my work goals and confident I can meet them.					

(continued)

Questions	Strongly disagree	Disagree	Neutral	Agree	Strongly agree
24. In my organization, I have the opportunity to do what I do best every day.					
25. The mission/purpose of my company makes me feel my job is important.					
26. In the last 7 days, I have been given the recognition or praise for doing good work.					
27. I rarely think to shift to another organization.					
28. My fellow employees are committed to doing quality work.					
29. In my organization, employees are willing to take on new tasks as needed.					
30. In my organization, employees deal very well with unpredictable or changing work situations.					
31. In my organization an environment of trust exists among the employees.					
32. How do you regard the firm's status (keeping in mind the current state of the economy)?					
☐ It is the best possible					
☐ It is in good shape					
☐ It makes some decent efforts					
☐ It is in a bad situation					
Open question:					
33. What can this organization do in order to find incentives so to increase the satisfaction and commitment of its employees?					

3.2 *The Demographic Characteristics of the Sample and Descriptive Statistics of the Questionnaire*

The general demographic characteristics show that the majority of the participants are males (Table 1) while regarding the participating employees' designation, most of the participants in the questionnaire were employed at the customer service (72%) and to HR department (13%). Also, the mean age of the respondents is 42.5 years old, which is a quite positive since they are on a productive age. Also, the

Table 1 Gender of the participants

		Frequency	Percent	Cumulative percent
Valid	Male	77	57.0	57.0
	Female	58	43.0	100.0
	Total	135	100.0	

participants are of high educational level since more than the 65% of them hold a university or postgraduate degree.

For the main items of the questionnaire, pertaining to satisfaction and engagement, the following are tested: Questions 1 through to 20 assessed job satisfaction, while questions 21–31 examined employee engagement and incentives. The results of the respondents to those questions are presented below.

3.2.1 Satisfaction

Overall 34% of the sample declared that they were satisfied with their working conditions, including issues like working hours, hygienic situation, break time, flexibility in timing, location of the work etc. Another 34% disagreed with this statement. The remaining 32% was neither satisfied nor dissatisfied.

From Tables 2 and 3 we may suggest that 43% of the sample was satisfied with the security their job offers them. Tables 4 and 5 show that overall 51% were satisfied with how often they create new ideas, procedures or things while 44% were satisfied with how often they take part in problem solving (Table 5).

Overall 44% were satisfied with how often they share knowledge with others (N = 59). In the following page, Table 6 presents the findings.

Only 32% of the sample were satisfied with the amount of resources they have to do their job. Twenty-three percent (23%) were not satisfied with the amount of available resources, and 45% were neither satisfied nor dissatisfied (Table 7). Four out of ten were satisfied with the opportunities they have to develop skills that interest them. Twenty-five percent were not satisfied with the available opportunities; and 38% remained neutral (Table 8). Overall 34% were satisfied with the amount of time they had in order to do their job. Almost three out of ten declared that they were not satisfied with the available amount of time and 38% remained neutral (Table 9).

Overall, 47% were satisfied with the amount of training they get (Table 10), while, 33% of the respondents were satisfied with their current position (N = 45). Thirty-six percent were dissatisfied with their position in the organization (Table 11). One third (33%) of the respondents agreed that their supervisor is a fair and reasonable person. Forty-one percent (41%) of the respondents did not agree that their supervisor is fair and reasonable (Table 12).

Table 2 Satisfaction with working conditions

	Frequency	Percent	Cumulative percent
Strongly agree	5	3.7	3.7
Agree	41	30.4	34.1
Neutral	43	31.9	65.9
Disagree	45	33.3	99.3
Strongly disagree	1	.7	100.0
Total	135	100.0	

Table 3 Satisfaction with the security my job offers me

	Frequency	Percent	Cumulative percent
Strongly agree	17	12.6	12.6
Agree	41	30.4	43.0
Neutral	36	26.7	69.6
Disagree	38	28.1	97.8
Strongly disagree	3	2.2	100.0
Total	135	100.0	

Table 4 Satisfaction related with ability to create new ideas, procedures or things

		Frequency	Percent	Cumulative percent
Valid	Strongly agree	20	14.8	14.8
	Agree	49	36.3	51.1
	Neutral	43	31.9	83.0
	Disagree	23	17.0	100.0
	Total	135	100.0	

Table 5 Satisfaction with how often I take part in problem solving

		Frequency	Percent	Valid percent	Cumulative percent
Valid	Strongly agree	6	4.4	4.5	4.5
	Agree	53	39.3	39.8	44.4
	Neutral	47	34.8	35.3	79.7
	Disagree	26	19.3	19.5	99.2
	Strongly disagree	1	.7	.8	100.0
	Total	133	98.5	100.0	
Missing		2	1.5		
Total		135	100.0		

Table 6 Satisfaction with how often I share knowledge with others

	Frequency	Percent	Cumulative percent
Strongly agree	18	13.3	13.3
Agree	41	30.4	43.7
Neutral	54	40.0	83.7
Disagree	19	14.1	97.8
Strongly disagree	3	2.2	100.0
Total	135	100.0	

One out of three (33%) of the participants agreed that their supervisor has adequate knowledge to make decisions about their job. Thirty-five percent disagreed that their supervisor possesses such knowledge and 33% neither agreed nor disagreed with that statement (Table 13). Almost five out of ten (47%) of the respondents agreed that they are paid fairly for the work they do (N = 63). Eighteen percent

Table 7 Satisfaction with the amount of resources I have to do my job

	Frequency	Percent	Cumulative percent
Strongly agree	16	11.9	11.9
Agree	27	20.0	31.9
Neutral	61	45.2	77.0
Disagree	20	14.8	91.9
Strongly disagree	11	8.1	100.0
Total	135	100.0	

Table 8 Satisfaction with the opportunities I have to develop skills that interest me

	Frequency	Percent	Cumulative percent
Strongly agree	13	9.6	9.6
Agree	37	27.4	37.0
Neutral	51	37.8	74.8
Disagree	33	24.4	99.3
Strongly disagree	1	.7	100.0
Total	135	100.0	

Table 9 Satisfaction with the amount of time I have to do my job

	Frequency	Percent	Cumulative percent
Strongly agree	12	8.9	8.9
Agree	34	25.2	34.1
Neutral	51	37.8	71.9
Disagree	38	28.1	100.0
Total	135	100.0	

Table 10 Satisfaction with the amount of training I get

	Frequency	Percent	Cumulative percent
Strongly agree	17	12.6	12.6
Agree	47	34.8	47.4
Neutral	28	20.7	68.1
Disagree	39	28.9	97.0
Strongly disagree	4	3.0	100.0
Total	135	100.0	

Table 11 Satisfaction with my current position

	Frequency	Percent	Cumulative percent
Strongly agree	8	5.9	5.9
Agree	37	27.4	33.3
Neutral	41	30.4	63.7
Disagree	41	30.4	94.1
Strongly disagree	8	5.9	100.0
Total	135	100.0	

Table 12 My supervisor is a fair and reasonable person

	Frequency	Percent	Cumulative percent
Strongly agree	7	5.2	5.2
Agree	38	28.1	33.3
Neutral	35	25.9	59.3
Disagree	52	38.5	97.8
Strongly disagree	3	2.2	100.0
Total	135	100.0	

Table 13 My supervisor has adequate knowlwdge to make decisions about my job

		Frequency	Percent	Cumulative percent
Valid	Strongly agree	14	10.4	10.4
	Agree	30	22.2	32.6
	Neutral	44	32.6	65.2
	Disagree	41	30.4	95.6
	Strongly disagree	6	4.4	100.0
	Total	135	100.0	

Table 14 I am paid fairly for the work I do

		Frequency	Percent	Cumulative percent
Valid	Strongly agree	16	11.9	11.9
	Agree	47	34.8	46.7
	Neutral	47	34.8	81.5
	Disagree	24	17.8	99.3
	Strongly disagree	1	.7	100.0
	Total	135	100.0	

Table 15 In my organization, job promotions are fair and objective

		Frequency	Percent	Cumulative percent
Valid	Strongly agree	12	8.9	8.9
	Agree	48	35.6	44.4
	Neutral	53	39.3	83.7
	Disagree	18	13.3	97.0
	Strongly disagree	4	3.0	100.0
	Total	135	100.0	

disagreed (18%), while 35% neither agreed nor disagreed that they are paid equitably for their work (Table 14). Four out of ten of participating employees agreed that in their organization, job promotions are fair and objective. Sixteen percent disagreed (16%), and 39% neither agreed nor disagreed (Table 15). Only 51% agreed that their coworkers respect each other‘s opinions and values. The rest of them (24%) did not agree with this statement (Table 16). Forty-one percent agreed that

Table 16 My coworkers respect each other's opinions and values

		Frequency	Percent	Cumulative percent
Valid	Strongly agree	19	14.1	14.1
	Agree	50	37.0	51.1
	Neutral	34	25.2	76.3
	Disagree	25	18.5	94.8
	Strongly disagree	7	5.2	100.0
	Total	135	100.0	

Table 17 My job uses my best abilities

		Frequency	Percent	Cumulative percent
Valid	Strongly agree	8	5.9	5.9
	Agree	47	34.8	40.7
	Neutral	56	41.5	82.2
	Disagree	24	17.8	100.0
	Total	135	100.0	

their job uses their best abilities. Eighteen percent disagreed (18%); and 42% neither agreed nor disagreed that their job utilizes their best abilities (Table 17).

Almost three out of ten agreed that their company's policies and procedures are clearly communicated. Thirty-seven percent (37%), however, did not agree that this is the case; and 36% neither agreed nor disagreed (Table 18). Overall 40% agreed that their company's policies and procedures create and effective work environment. However, 34% of the sample did not agree (Table 19). Thirty-nine percent agreed that they have sufficient opportunities for professional growth; 20% disagreed; and 41% neither agreed nor disagreed that they receive adequate opportunities for professional growth Table 20). Only three out of ten of the respondents were satisfied that they work in a dynamic start-up company; 35% were not satisfied that this is the case; and 33% kept a neutral position (Table 21).

3.2.2 Engagement

With regard to employee engagement, the following were found:

Overall 26% agreed that they are completely focused on their job duties (N = 35). On the other hand, 44% disagreed that they are fully focused at work (N = 59). Table 22 presents these results.

Only 27% agreed that they are determined to give their best effort at work each day (N = 36). However, 34% disagreed that this is so (N = 46), and 39% neither agreed nor disagreed (Table 23). Thirty-six percent agreed that they are determined to accomplish their work goals and that they are confident they can meet those goals. One third of the participants did not agree with this (Table 24). Overall, 51% agreed that in their organization, they have the opportunity to do what they do best every day (Table 25).

Table 18 My company's policies and procedures are clearly communicated

		Frequency	Percent	Valid percent	Cumulative percent
Valid	Strongly agree	15	11.1	11.2	11.2
	Agree	21	15.6	15.7	26.9
	Neutral	48	35.6	35.8	62.7
	Disagree	33	24.4	24.6	87.3
	Strongly disagree	17	12.6	12.7	100.0
	Total	134	99.3	100.0	
Missing		1	0.7		
Total		135	100.0		

Table 19 My company's policies and procedures create an effective environment

		Frequency	Percent	Valid percent	Cumulative percent
	Strongly agree	11	8.1	8.2	8.2
	Agree	42	31.1	31.3	39.6
	Neutral	35	25.9	26.1	65.7
	Disagree	43	31.9	32.1	97.8
	Strongly disagree	3	2.2	2.2	100.0
	Total	134	99.3	100.0	
Missing		1	.7		
Total		135	100.0		

Table 20 I have sufficient opportunities for professional growth

		Frequency	Percent	Cumulative percent
Valid	Strongly agree	19	14.1	14.1
	Agree	34	25.2	39.3
	Neutral	55	40.7	80.0
	Disagree	24	17.8	97.8
	Strongly disagree	3	2.2	100.0
	Total	135	100.0	

Table 21 I am satisfied working in a dynamic bank

	Frequency	Percent	Cumulative percent
Strongly agree	2	1.5	1.5
Agree	41	30.4	31.9
Neutral	45	33.3	65.2
Disagree	44	32.6	97.8
Strongly disagree	3	2.2	100.0
Total	135	100.0	

Table 22 I am completely focused on my job duties

	Frequency	Percent	Cumulative percent
Strongly agree	6	4.4	4.4
Agree	29	21.5	25.9
Neutral	41	30.4	56.3
Disagree	52	38.5	94.8
Strongly disagree	7	5.2	100.0
Total	135	100.0	

Table 23 I am determined to give my best effort at work each day

	Frequency	Percent	Cumulative percent
Strongly agree	11	8.1	8.1
Agree	25	18.5	26.7
Neutral	53	39.3	65.9
Disagree	43	31.9	97.8
Strongly disagree	3	2.2	100.0
Total	135	100.0	

Table 24 I am determined to accomplish my work goals and confident I can meet them

		Frequency	Percent	Cumulative percent
Valid	Strongly agree	10	7.4	7.4
	Agree	39	28.9	36.3
	Neutral	46	34.1	70.4
	Disagree	39	28.9	99.3
	Strongly disagree	1	.7	100.0
	Total	135	100.0	

Table 25 In my organization, I have the opportunity to do what I do best every day

	Frequency	Percent	Cumulative percent
Strongly agree	13	9.6	9.6
Agree	56	41.5	51.1
Neutral	43	31.9	83.0
Disagree	16	11.9	94.8
Strongly disagree	7	5.2	100.0
Total	135	100.0	

Four out of ten of the respondents agreed that the mission/purpose of their company makes them feel that their job is important while three out of ten disagreed with this statement and the rest remained neutral (Table 26). Fifty percent agreed that they rarely think to shift to another organization while 30% disagreed with the statement (Table 27). Forty-seven percent of the respondents agreed that in the last 7 days, they have been given recognition or praise for doing good work, 16% dis-

Table 26 The mission/purpose of my company makes me feel my job is important

	Frequency	Percent	Cumulative percent
Strongly agree	13	9.6	9.6
Agree	39	28.9	38.5
Neutral	47	34.8	73.3
Disagree	24	17.8	91.1
Strongly disagree	12	8.9	100.0
Total	135	100.0	

Table 27 I rarely think to shift to another organization

	Frequency	Percent	Cumulative percent
Strongly agree	13	9.6	9.6
Agree	55	40.7	50.4
Neutral	27	20.0	70.4
Disagree	36	26.7	97.0
Strongly disagree	4	3.0	100.0
Total	135	100.0	

Table 28 In the last 7 days, I have been given recognition or praise for doing good work

		Frequency	Percent	Cumulative percent
Valid	Strongly agree	9	6.7	6.7
	Agree	54	40.0	46.7
	Neutral	51	37.8	84.4
	Disagree	18	13.3	97.8
	Strongly disagree	3	2.2	100.0
	Total	135	100.0	

Table 29 My fellow employees are committed to doing quality work

	Frequency	Percent	Cumulative percent
Strongly agree	11	8.1	8.1
Agree	54	40.0	48.1
Neutral	26	19.3	67.4
Disagree	38	28.1	95.6
Strongly disagree	6	4.4	100.0
Total	135	100.0	

agreed and 38% provided a neutral response to this item (Table 28). Overall 48% agreed that their fellow employees are committed to doing quality work (N = 65); 33% disagreed (N = 44) (Table 29). Fifty-three percent agreed that in their organization, employees are willing to take on new tasks as needed (Table 30).

Only 27% of the participants agreed that in their organization, employees deal very well with unpredictable or changing work situations (Table 31). In the last

Table 30 In my organization, employees are willing to take on tasks as needed

	Frequency	Percent	Cumulative percent
Strongly agree	21	15.6	15.6
Agree	50	37.0	52.6
Neutral	21	15.6	68.1
Disagree	42	31.1	99.3
Strongly disagree	1	.7	100.0
Total	135	100.0	

Table 31 In my organization, employees deal very well with unpredictable or changing work situations

	Frequency	Percent	Cumulative percent
Strongly agree	12	8.9	8.9
Agree	25	18.5	27.4
Neutral	35	25.9	53.3
Disagree	41	30.4	83.7
Strongly disagree	22	16.3	100.0
Total	135	100.0	

Table 32 In my organization an environment of trust exists among the employees

	Frequency	Percent	Cumulative percent
Strongly agree	13	9.6	9.6
Agree	47	34.8	44.4
Neutral	37	27.4	71.9
Disagree	35	25.9	97.8
Strongly disagree	3	2.2	100.0
Total	135	100.0	

Table 33 How do you regard the firm's status (keeping in mind the current state of the economy)?

	Frequency	Percent	Valid percent
It is in good shape	12	8.9	9.0
It makes some decent efforts	68	50.4	50.7
It is in a bad situation	54	40.0	40.3
Total	134	99.3	100.0
Missing	1	.7	
Total	135	100.0	

questions regarding employee engagement almost one out of two of the respondents agreed that in their organization, an environment of trust exists among the employees (Table 32). A further question asked of the respondents to indicate their regard for the status of the firm, given the current state of the economy. As can be seen, 9% replied that the organization's status is "in good shape". The majority of the respontents answered that the company "makes some decent efforts" (51%); and 40% responded that the organization is "in a bad situation" (Table 33).

An open-ended question was also posed to the participants, in addition to the closed-ended items from the satisfaction and engagement questionnaires. They were asked for their opinion regarding what this organization can do in order to increase the satisfaction and engagement of its employees, the respondents provided answers that were assignable to two categories. In all, 78 responses (N = 78) were provided and were coded into mutually-inclusive categories. The first category that emerged addresses the need for a clearer description and definition of employee responsibilities especially as they relate to interdepartmental interaction. This suggestion was made by N = 42 respondents. The second category addresses the need for more staff hiring, as well as for the hiring of staff that is well qualified. This suggestion was made by N = 36 respondents.

3.3 Inferential Statistics

We have to mention that the results of the study is not possible to be generalized to the respective population due to the sampling methodology we followed.

Now, our purpose is the level of job satisfaction. As it was described earlier the average responses of the sample to each separate item of the satisfaction scale ranged between 2.88 and 3.49, which suggests that the satisfaction levels were not high, but moderate. An Alpha Cronbach reliability analysis was performed in order to ascertain whether the 20 items of satisfaction can reliably be used as a single factor or dimension. Results showed that there was a very high and acceptable reliability of a =0.96. The computation of the Satisfaction Factor produced a mean overall score of 3.2 (sd = 0.77). Table 34 presents the Cronbach's reliability result for the items, as well as the mean and standard deviation for the resultant single factor.

Therefore, *the level of job satisfaction of the employees was found to be moderate.*

Regarding the level of engagement, it was reported earlier that the mean scores ranged from 2.73 to 3.39, revealing the levels of employee engagement to be moderate. The Cronbach test showed a high reliability of a =0.84. The single Engagement Factor that was computed had a mean of 3.14 (sd = 0.64). Table 35 presents the reliability result and the mean and standard deviation for the engagement factor.

Table 34 Reliability, Mean and Standard Deviation for the items of satisfaction

	Cronbach's reliability		Resultant scale		
	Alpha	N of Items	N	Mean	Std. Deviation
Satisfaction	.964	20	131	3.20	.765

Table 35 Reliability, Mean and Standard Deviation for the items of engagement

	Cronbach's reliability		Resultant scale		
	Alpha	N of items	N	Mean	Std. deviation
Satisfaction	0.837	11	135	3.14	0.635

Therefore, ***the level of engagement of the employees was also found to be moderate***.

Finally, two further ANOVA tests were utilized in order to examine whether the different work designations have an influence on the scores of the satisfaction and engagement factors, with "designation" as the independent variable. There were no statistically significant differences between the different functions, in satisfaction ($F = 1.44$, $df = 8$, $p = 0.19$) or in engagement ($F = 0.73$, $df = 9$, $p = 0.68$). Hence, ***the levels of job satisfaction and employee engagement were not influenced by the different functions***, either.

So, as reported earlier, given the special circumstances of the current economy, only one out of ten participants viewed the company's status in a somewhat positive light, replying that it is "in good shape". One in two respondents replied that, keeping in mind the current state of the economy, the ban "makes some decent efforts". However, no one from the 135 participants agreed that the bank is in its best possible state, and 40% agreed that it is not in good shape ("it is in a bad situation"). Thus, taking into account the fact that both satisfaction and engagement were found to be moderate in the present research, the special circumstances of the organization appear to have had a negative impact on the scores to those two scales.

This finding was tested through the use of an analysis of variance test with item 32 (bank status) as the independent variable and satisfaction and engagement as the dependent variables. As can be seen in Table 36, the results showed that there is a significant difference in mean satisfaction depending on the perceived status of the organization given the current state of the economy ($F = 3.13$, $df = 2$, $p = 0.047$). The difference in engagement was not statistically significant ($F = 0.67$, $df = 2$, $p = 0.51$).

Besides this, we found that (chi square) the level of satisfaction within a firm depends on its performance during a crisis. Overall, it seems that this is major incentive for the employees; to see that their firm will be able to cope with the economic crisis.

Table 36 Analysis of Variance for satisfaction and engagement (firm status)

		Sum of squares	df	Mean square	F	Sig.
Satisfaction	Between Groups	3.539	2	1.769	3.140	0.047
	Within Groups	71.576	127	0.564		
	Total	75.115	129			
Engagement	Between Groups	.543	2	0.272	0.674	0.511
	Within Groups	52.758	131	0.403		
	Total	53.301	133			

	Value	df	Asymp. Sig. (2-sided)
Pearson Chi-Square	69,281[a]	3	,000
Likelihood Ratio	26,426	3	,000
Linear-by-Linear Association	25,180	1	,000
N of Valid Cases	106		

4 Conclusions

The scope of the study is to examine the ability of firms to link satisfaction with engagement during tough times for businesses as well as the role of incentives. For example, we notice that a key incentive is the performance of firms; when the employees see that their firm is able to cope then this leverages their efforts and they are satisfied from this outcome. This is the outcome of a quantitative research which occurred in a sample of 135 persons working for Bank of Piraeus. Thus, the respective outcomes of this study are indicative for this bank and should not be generalized.

For the present sample, the main demographic characteristics are the following: More than half of the participants are male (57%), all are employees of various designations (most notably customer support) while the average age is 42.5 years which indicates that the participants are in the most productive age.

The levels of agreement to the questions of satisfaction ranged from 27% to 51%, with most items having agreement below 40%; only in two out of 27 questions did the majority agree with the statement. The mean scores for the satisfaction items ranged from 2.9 to 3.5, indicating a moderate level of satisfaction.

With regard to engagement, the frequency levels of agreement ranged from 26% to 53%, with only three out of nineteen items having the majority agreeing with the statement. The mean for the items of employee engagement ranged from 2.7 to 3.4, again signifying a moderate, neither positive nor negative, level of engagement.

The need for a clearer description and definition of employee responsibilities especially as they pertain to interdepartmental interaction, as well as the need for the hiring of staff, and the hiring of that is well qualified were, according to the participants, the most important actions that the organization could take so as to increase the satisfaction and engagement of its employees.

It was also found that the level of job satisfaction of the employees, as well as their level of employee engagement, was moderate. Both scales were found to be reliable with high, acceptable levels; and the resulting Satisfaction and Engagement single factors were equally moderate in size (3.2 and 3.1 respectively). Rich et al. (2010) claims that such a performance must be worrying. Surely this is not a negative outcome, but the firm's management needs to work more on improving those indicators and provide incentives. Right now the indicators are moderate which is something close to a "stuck in the middle" situation. Rich et al. (2010) indicates that today firms are operating in a very harsh environment. They have to cope with a situation where the crisis creates more needs and the employees often hear about negative situations, such as layoffs from other firms, which affect their mentality.

It was concluded that levels of job satisfaction are negatively impacted by the special circumstances of a start-up company operating within harsh economic conditions, which is something that affects the incentives given. The levels of employee engagement reported were not found to differ as a function of the same item. In the present study, none of the participants believed that the organization they work for has the best possible status in the harsh economic climate. Quite to the contrary,

four out of ten respondents believed that the organization's status is in a bad situation. One in two participants replied that, taking into account the current circumstances, the company is making a good effort. Thus, satisfaction was influenced by the firm status during the present economic conditions; but there was no evidence that engagement is also influenced. Wilkinson (2004) claims that we must not forget that employees are social beings. This means that they are affected from the overall situation that the economic crisis has created. Some of the employees seem to be moderated or having low expectations. This is due of the fact that the surrounding atmosphere and the bad news of the economies have an impact and everyone wants to support the start up but on the other hand they are quite moderate on what they say and what they do.

The outcome of the research indicates that the people of the sample may have the wrong perceptions about the achievement of the firms. So, it is important to change those perceptions, so to help the firms to recover and to speed up its performance. As said before, the research showed that there is a moderate level of engagement and of satisfaction. The research has also identified some of the causes of this situation, such as the unavailability of completed processes, conflicts and non-effective interdepartmental communication. What is positive is that those issues can be solved with managerial interventions and they do not need much financial resources.

Despite of the fact that the study indicates that the employee engagement is not influenced from the special circumstances that the firm operates, it is essential to work on this since in the long run the employee engagement affects many aspects of the firm and it can contribute on the optimization of this performance.

The interventions that can be done are related with incentives and be interventions which will solve the existing problems. Hence, this can be on the form of a change process, which will start from a bottom-up process. This will mean that the firm would have to startup a process where it will consult its staff about the changes, they will ask to write down what they do not like and then to work on how to make improvements.

What is also important is to work on the job environment and climate. Based on what Harters et al. (2002) have said about the impact of the outer climate on the performance of firms, especially of banks. It is understood that the current economic climate is not the ideal one. The employees feel quite pressed from the current situation with the economic crisis and this affects their overall perception. For this reason, it is important from the management to ensure that despite of the negative economic climate, the firm is in a stable position and in the future it will more much forward. This can be made by providing the employees with a safety net which will ensure that viability of this firm. This can be done by providing some tacit examples of how the firm copes, such as the financial performance of the firm, so to make sure that it is on the right path.

Of course, all the above hold only for this case study and no population inference can be made. So, a future research can take place in a sample made from a number of firms from different European and non-European countries which will do an in-depth analysis of firms from within. Also, we need to know how much the level of country development affects job satisfaction and commitment. This means that a

case study approach must be used so to investigate in-depth what is going and how the firms respond on the variables examined.

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The Role of Employee Diversity, Inclusion and Development for Socially Responsible Management Strategies and Financial Performance of European Companies

Gratiela Georgiana Noja, Mirela Cristea, Ioana Banaduc, Gheorghe Preda, and Constantin Stefan Ponea

Abstract This research examines the financial performance of European companies under the shaping factors of human capital features, namely employee diversity, inclusion and development. Further, the research configures several aggregated pillars and management strategies that need to be accounted by companies to enhance environmental, social and governance (ESG) achievements with benefit spillovers on the financial performance and firm profitability. The research endeavor relies on a complex dataset extracted from the Thomson Reuters database comprising a sample of 1722 firms with the company headquarters in Europe and new data for the last fiscal year (2019). Four basic ESG pillars (gender diversity, inclusion, people development and controversies) are the core elements used in our research. The methodology combines structural equation modelling (processed through the maximum likelihood estimator) with network analysis (configured based on partial correlations). Main results bring to the fore that human capital is essential for company financial performance, employee and executive management gender diversity and people development (training hours, training allocations/costs, employee satisfaction) being the main dimensions that have proved to reduce the financial risk and

G. G. Noja · G. Preda
Faculty of Economics and Business Administration, Department of Marketing and International Economic Relations, West University of Timisoara, Timisoara, Romania
e-mail: gratiela.noja@e-uvt.ro; gheorghe.preda@e-uvt.ro

M. Cristea (✉)
Faculty of Economics and Business Administration, Department of Finance, Banking and Economic Analysis, University of Craiova, Center for Banking and Financial Research, Craiova, Romania
e-mail: simona.cristea@edu.ucv.ro

I. Banaduc
Department of Teacher Training, West University of Timisoara, Timisoara, Romania
e-mail: ioana.banaduc@e-uvt.ro

C. S. Ponea
Faculty of Legal, Economic and Administrative Sciences, Department of Economics, Spiru Haret University, Craiova, Romania

K. Nermend et al. (eds.), *Decision-Making in Management*, Contributions to Management Science, https://doi.org/10.1007/978-3-030-67020-7_17

enhance firm profitability. Moreover, ESG diversity, inclusion and people development credentials have positive effects on firm outputs, while ESG controversies pillar induces an unfavorable impact.

Keywords Human capital management · Financial performance · Gender diversity · Responsible strategies · Econometric modelling

JEL Classification L25 · M12 · M50

1 Introduction

The significance of sustainable and responsible investment strategies has grown over the years because of the increasing awareness of environmental stability and socio-economic development of countries. These rational investment strategies grasp environmental, social and governance (ESG) aspects so that the risk management is strengthened and sustainable performance for investors is generated, thus supporting the decision-making in management. Thereby, corporate social responsibility (CSR) encloses a combination, on the one hand, of ESG factors and, on the other hand, of financial factors, with the aim to contribute to the process of making decisions regarding companies' investments (Brogi and Lagasio 2019; Dalal and Thaker 2019). Consequently, ESG practices are related to: environmental protection—namely, waste and pollution, resource depletion, climate change; social responsibilities—employee diversity and relations, working conditions, health and safety, conflict; and governance—leadership of a company, audits, shareholder protection, tax strategy, corruption, bribery, executive remuneration (Clementino and Perkins 2020; Zahid et al. 2019). Since CSR has become increasingly relevant in academia over the years, worldwide organizations have felt the need to adjust to these tasks in order to maximize their profitability and productivity. In addition, there has been the constant demand from consumers, suppliers, investors and non-governmental organizations to invest in the development and implementation of CSR practices. Thus, the companies were actively conforming to the ESG scores by implementing new policies in different fields, for instance human rights, diversity and governance issues (Clementino and Perkins 2020). According to Refinitiv (2018), the diversity and inclusion (*D&I*) within ESG components comprises four pillars: the diversity of management and executive employees, the inclusion of employees, people development, and news and controversies.

On this frame of reference, the objective of our research is to appraise the interlinkages of the four basic ESG pillars (gender diversity, inclusion, people development and controversies) with the financial performance and firms' profitability. The research endeavor relies on a complex dataset extracted from the Thomson Reuters database (2020), comprising a sample of 1722 firms with the company headquarters in Europe and new data for the last fiscal year (2019). The research methodology encloses two econometric procedures, namely: (a) structural equation modelling—

SEM, processed through maximum likelihood estimator with missing values to cover for data benchmarking; and (b) network analysis by applying the Gaussian Graphical Models (GGM), configured based on partial correlations.

The remaining part of the book chapter is organized as follows: Section 2 as brief literature review, Sect. 3 discusses the data used in the empirical analysis and the methodology applied. Section 4 presents the results of the structural equation modelling and network analysis through Gaussian Graphical Models, along with comprehensive discussion, while the final section comprises the concluding remarks. Additional information is presented in the Appendix to support the econometric analysis.

2 Brief Literature Review

The role of both corporate social responsibility (CSR) performance, and diversity and inclusion (D&I) at the workplace (as main components of CSR), on the financial performance of the companies has become a core subject on the literature underpinnings.

Thereby, as regards the effect of CSR performance (reflected by environmental, social and governance scores—ESG) on firms' financial performance, Krishnaswamy et al. (2020), using a panel of 501 companies from India, for a period of seven fiscal years (from 2012 to 2018), highlighted that CSR performance had a positive and significant effect on the financial performance of companies (measured by Return on Assets—ROA, Return on Equity—ROE, Return on Capital Employed—ROCE, and Price to book Ratio—Tobin's Q). Brogi and Lagasio (2019), analyzing the ESG relationships with financial performance for the industrial and financial companies from the United States of America (USA), concluded that the enforcement of an environmental strength policy plays an important role in fostering bank's profitability in the long run, on the one hand, and a slowness of profitability in the case of industrial companies that do not invest more in ESG activities, on the other hand. Also, Ruf et al. (2001), Orlitzky et al. (2003), Bird et al. (2007), Dalal and Thaker (2019), Cheung et al. (2010) and Mutuc and Lee (2019) proved that CSR has positively influenced the financial performance of analyzed companies. Comprising the controversies variable by the side of ESG components (ESGC), Rodríguez-Fernández et al. (2019) have revealed the same favorable influence of ESGC on the financial performance, measured by ROA and ROE, and any significant influence as regards Tobin's Q, for tourism companies (data extracted from Thomson Reuters database at the level of 2017). Opposite, Duque-Grisales and Aguilera-Caracuel (2019) have identified that high ESG scores are negatively related to financial performance of the companies from Latin America, due to the fact that companies do not implement the ESG initiatives in an effective and good way, but rather in an ineffective one. Researchers (Duque-Grisales and Aguilera-Caracuel 2019) appreciated that if multinationals invest more in applying the ESG principles (related to the environment protection, the social diversity and well-being, the lack of corruption,

bribery etc.), these investments, which come as sacrifices, would be more visible in their reports. By considering the case of the Indian companies, Woo and Sekyung (Woo and Sekyung 2019, p. 1790) have revealed a U-shaped relation between CSR and the financial performance measured by Tobin's Q rate (CSR related to firm value), and any significant relation when financial performance was expressed by ROA (no relation of CSR with "accounting performance").

Khan et al. (2017) examined the relationship between gender diversity within the corporate board and the financial performance, using a sample of 100 non-financial companies from Malaysia, for 2009–2013 timespan. Their results highlighted that gender diversity has a positive and significant influence on the financial performance of the company, measured by the return on equity (ROE). On the same line, Reguera-Alvarado et al. (2017) investigated the relationship between gender diversity and financial performance of the Spanish companies, for a panel of 125 companies listed on the Madrid Stock Exchange from 2005 to 2009. The results showed that an increase in the number of females on boards of directors will lead to an increase of companies' performance.

Including ethnic diversity alongside with gender representation on board of directors, Erhardt et al. (2003) analyzed their implications on the financial performance (measured by Return on Assets—ROA, and return on investments) of 112 United States (US) companies. The results obtained indicated that demographic diversity (ethnic and gender) is positively associated with the financial performance of the studied companies. Ahmed and Bukth (2019) studied the effects of gender, religious and racial diversity on organizational performance, for a number of 80 companies listed on the Dhaka Stock Exchange. Their results indicated a positive and significant relationship only between gender diversity and company's performance, measured by the operating profit margin. The primary data were collected using the questionnaire, and some secondary data on financial performance were collected from the companies' websites.

Comprising the risk-taking behavior by the side of gender diversity's implications on financial performance and firms' dimension, Horak and Cui (2017) substantiated that companies with female representation on the board of directors have a higher growth rate of assets and a lower debt to asset ratio than the companies without female involvement. The research was conducted on a number of 120 companies in the Chinese automotive industry (manufacturers and distributors).

As regards the inclusion at the workplace of particular categories of people (with disabilities), Lips (2018) built up a model that studied the interaction between inclusion, the financial performance of the company and its characteristics, namely company's size, seniority on the market and whether or not it is a family business. The results obtained, using a sample of 322 companies in the Netherlands, showed that companies without employees with disabilities achieved a higher level of performance (expressed by Return on Assets, ROA) compared with companies including workers with disabilities. Moreover, the negative effect of hiring people with disabilities is stronger in the case of large companies and for family businesses. These findings entail that, besides financial government support for the workforce inclusion of disabled people, non-financial incentives received from the government,

such as „assisting organizations in their attempts at making work suitable for disabled people, in recruiting fitting candidates and with training for hired employees" (Lips 2018, p. 29), are also necessary for a successful integration of disabled employees within companies.

The research conducted by Johnson et al. (2019) focused on the effect of socio-cultural diversity (age, gender, ethnic, religious, cultural differences and physical ability) on the performance of private healthcare organizations from Nigeria (the Kogi State). The organizations performance was examined by patient satisfaction, financial performance and technological innovation. The results showed that age diversity, physical capacity and religious diversity have positive and significant influenced patient satisfaction. Only ethnic diversity had a negative and significant effect on patient satisfaction. Ethnic, cultural and gender diversity also have a positive and significant impact on financial performance of private healthcare organizations, on the one hand. On the other hand, age and religious diversity have a negative impact on financial performance. As regards technological innovation, positive and significant impacts had physical capacity, age, cultural and gender diversity, while religious diversity registered a negative effect on technological innovation.

3 Data and Methodology

3.1 Research Hypotheses

In accordance with the general purpose of our research endeavor and considering the main findings and existing gaps in the scientific literature, we target the following research hypotheses:

- H1: There are significant interlinkages between the four basic ESG pillars (gender diversity, inclusion, people development and controversies) jointly with key human capital credentials and the financial performance of the European companies considered;
- H2: There are significant connections between several human capital dimensions and individual indicators reflecting diversity, inclusion and people development (without the general ESG Diversity and Inclusion pillars) and the financial performance of the European companies considered.

3.2 Data, Sample, Indicators and Sources

The data were extracted from Thomson Reuters Eikon database (2020), TR ESG (Economic, Social, Governance) indicators, Gender Diversity section, Diversity and Inclusion report. The panel comprises public companies with the headquarters in Europe with data for the last fiscal year (FY0) and next fiscal year (FY1) company update, including ESG period reporting last updates from February 2020 (FYO).

Thomson Reuters ESG universe comprises of over 6000 global, public organizations (Thomson Reuters 2017). The inceptive panel covered a number of 1744 companies, geographically disposed in Europe according to the company headquarters, as follows: United Kingdom (UK) (442), Germany (176), France (152), Switzerland (134), Sweden (132), Italy (95), Spain (70), Netherlands (68), Norway (53), Belgium (49), Ireland (45), Russia (45), Denmark (43), Poland (42), Finland (37), Austria (34), Greece (26), Luxembourg (25), Guernsey (20), Portugal (15), Jersey-UK (8), the Czech Republic (5), Hungary (5), Slovenia (1), Cyprus (5), Malta (4), Monaco (4), Isle of Man (3), Romania (2), Liechtenstein (1), Gibraltar (1), Ukraine (1) and Faroe Islands (1). The set of companies from Cyprus, Malta, Monaco, Isle of Man, Romania, Liechtenstein, Gibraltar, Ukraine and Faroe Islands were removed from the panel because of numerous missing values for the ESG D&I indicators. The final data sample used for the econometric analysis enclosed a total number of 1722 companies from different industries.

The set of indicators selected for the empirical endeavor covers de following components:

- "ESG Diversity and Inclusion (D&I) scores" (Refinitiv 2018, p. 2);
- Human capital and people development indicators;
- Financial performance and profitability indicators.

"ESG Diversity and Inclusion scores", as the core elements used in our research, include the following components, with values ranging from 0 to 100 (Σ = Median) (Refinitiv 2018, p. 4): "*Diversity score"*, *TRDIR_DIV*; "*Inclusion score"*, *TRDIR_INCL*; "*People Development score"*, *TRDIR_PD*; "*News and Controversies score"*, *TRDIR_CONTR*. *ESG "Diversity pillar*" comprises: "board gender diversity (%), board member cultural diversity (%), women employees (%), new women employees (%), women executive employees (%), women managers (%), diversity process (Yes/No—Y/N) and diversity objectives (True/Negative—T/N)". *ESG "Inclusion pillar*" comprises: "flexible working hours (Y/N), day care services (Y/N), employees with disabilities (Y/N), Human Rights Campaign (HRC) corporate equality index (numeric), HIV/AIDS (Y/N)". *ESG "People Development"* append: "internal promotion (Y/N), average training hours (numeric), management training (Y/N), career development processes (Y/N), employee satisfaction (%), skills training of employees (Y/N), training costs per employee" (United States Dollar—USD). *ESG "News and Controversies"* include: "diversity and opportunity controversies (numeric) and wages or working conditions controversies (numeric)".

Human capital and people development pillar comprises the following indicators: Number of employees from CSR reporting (*No_empl_CSR_rep, No_employees*) (FY0); Women employees (*Women_empl*), percent (FY0); Women managers (*Women_MGM*), percent (FY0); Executive members gender diversity (*EM_gen_div*), percent (FY0); Training hours paid by the employer (*Training_H*) (FY0, number); Training costs per employee (*Training_C*) (FY0, USD); Employee satisfaction (*Empl_satisf*), percent (FY0) (the percentage of employee satisfaction as reported by the company); Net employment creation (*Empl_creation*) (FY0); Turnover of employees (*Turn_empl*) (FY0).

Financial performance and profitability indicators include: Earnings before interest and taxes (*EBIT*), mean (FY1, USD); Earnings before interest, taxes, depreciation and amortization (*EBITDA*), mean (FY1, USD); Earnings per share (*Earn_share*), mean (FY1, USD); Return on Assets (*ROA*), mean, % (FY1); Return on Equity (*ROE*), mean, % (FY1); Net working capital (*Working_capital*), mean (FY1, USD).

Summary statistics of all the indicators used in our empirical analysis are detailed in Table 1. These statistics comprise the number of observations per each indicator (*N*), the mean values (*mean*), the standard deviation (*sd*), respectively the minimum (*min*) and maximum (*max*) values per indicator. The summary statistics (Table 1) entail that the largest values across the four coordinates of ESG diversity and inclusion pillar (*TRDIR_DIV, TRDIR_INCL, TRDIR_PD* and *TRDIR_CONTR*) are devoted to employee inclusion in terms of flexible working hours, day care services, employees with disabilities or human rights corporate equality (*TRDIR_INCL*), with an index maximum value of 94, as well as employee controversies related to diversity and promotion opportunities, wages or working conditions (*TRDIR_CONTR*), with an index maximum value of 100. This index of controversies also starts from a minimum value of 44, thus highlighting that this dimension weighs heavily in the ESG components of considered companies, compared to the other credentials of the Diversity and Inclusion pillar. At the same time, *TRDIR_PD*,

Table 1 Summary statistics

Variables	N	mean	sd	min	max
TRDIR_DIV	1660	32.28072	14.81929	0	77
TRDIR_INCL	1660	15.75602	20.49258	0	94
TRDIR_PD	1660	40.88253	21.90282	0	90
TRDIR_CONTR	1660	99.01566	5.08953	44	100
Women_empl	1336	37.14668	16.96752	1.6	92.96
Women_MGM	984	28.13615	13.21088	0	79
EM_gen_div	1676	13.96454	14.39437	0	100
Training_H	670	23.98945	19.24767	0	236.36
Training_C	273	972.4419	2885.414	.05	46667.08
Empl_satisf	281	75.81068	10.59586	3.9	96
Empl_creation	1617	8.15295	28.85968	−81.9	509.76
No_empl_CSR_rep	1271	28773.5	63539.02	0	664,496
Turn_empl	789	13.66901	10.30692	0	95.54
EBITDA	1474	1.39e+09	3.81e+09	−4.62e+08	5.97e+10
EBIT	1593	1.04e+09	2.67e+09	−5.95e+08	3.49e+10
Earn_share	1604	4.639121	57.61581	−15.07	2245.31
ROA	1722	4.182091	10.07174	−171.2	240.27
ROE	1722	12.84436	44.47888	−572.65	1028.29
Working_capital	1163	3.38e+08	2.84e+09	−1.96e+10	6.03e+10
N total (sample)	1722				

min minimum, *max* maximum, *N* number of observations, *sd* standard deviation, Source: own process of Thomson Reuters Eikon data in Stata 16

encompassing training hours, including management training, career development processes, employee satisfaction, skills training of employees, training costs per employee, also account a high maximum value of 90 across the 1660 companies with data for this index out of the 1722 companies from various industries comprised in our dataset.

The *ESG Diversity* pillar, comprising board gender diversity, board member cultural diversity, women employees, new women employees, women executive employees or managers, registers a maximum value of 77 across the 1660 companies with data for this pillar, much lower compared to the other ESG coordinates considered in the empirical analysis. According to the Thomson Reuters database (2020) and Refinitiv (2018, p. 7), a high D&I score entail very good performances achieved by the companies, namely „companies with the highest overall D&I scores (theoretical max 100) are very likely to be the best in class relative to their industry and country peers".

The panel evolution of each of the ESG pillars considered in the analysis, namely diversity, inclusion, people development and controversies, across the 1722 companies from various industries comprised in the dataset are enclosed into Fig. 1. In terms of the financial performance and profitability, measured in our empirical analysis through six indicators, *ROA, ROE, Working_capital, Earn_share, EBIT, EBITDA* (as recommended by Siminica et al. 2019), the evolution across over 1000 companies with data for these indicators as covered by the dataset compiled is presented in Fig. 2.

These trends entail several important variations and outliers that need to be considered in the methodological endeavor (the largest variations are accounted in terms of *Earn_share,* which ranges from a minimum value of −15.07 to a maximum value of 2245.31 across 1604 companies, with data reported for these indicators, but there are several peaks also in the case of ROA, ROE and working capital) (Fig. 2).

3.3 Methodology

The methodology is configured to accomplish the general objective of our research centered on appraising the interlinkages of the four basic ESG pillars (gender diversity, inclusion, people development and controversies), as well as of the human capital coordinates, with the financial performance and profitability of 1722 firms with the company headquarters in Europe. Hence, the research methodology relies on two econometric procedures, namely: (a) structural equation modelling—SEM, processed through maximum likelihood estimator with missing values to cover for data benchmarking; and (b) network analysis by applying the Gaussian Graphical Model (GGM), configured based on partial correlations. The general design of the SEM is presented in Figs. 3 and 4.

There are two sets of SEM models configured, one focusing on the ESG pillars jointly with three human capital key coordinates selected by the authors based on the literature review (Fig. 3), designed to test the first research hypothesis (H1) and

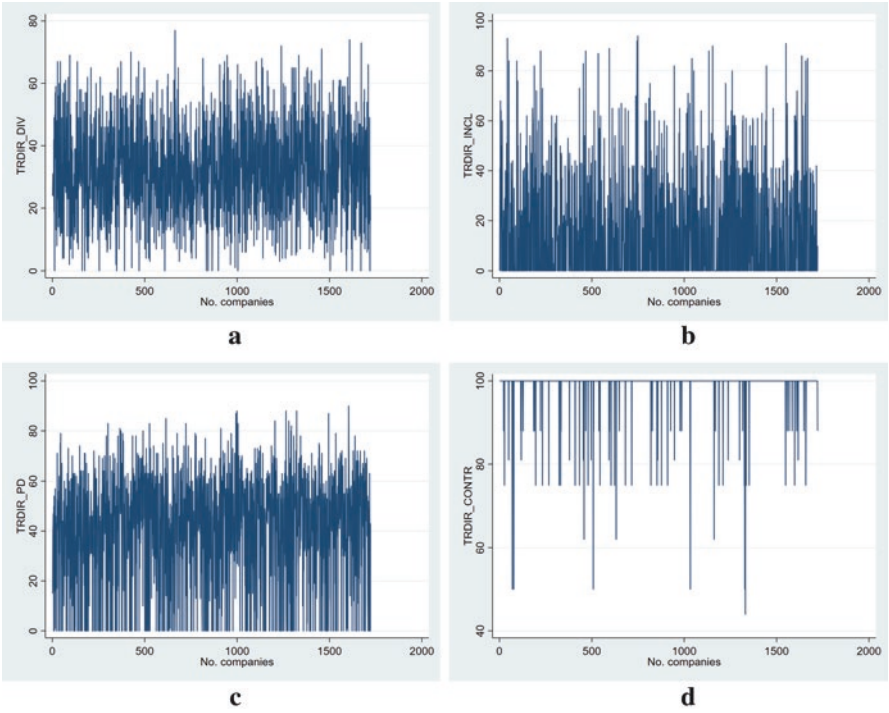

Fig. 1 Evolution of (**a**) ESG diversity, (**b**) ESG inclusion, (**c**) ESG people development and **d** ESG News and Controversies, across the 1722 companies from various industries comprised in the dataset. Source: own process of Thomson Reuters Eikon data (2020) in Stata 16

the other set focusing only on several human capital dimensions and individual indicators reflecting diversity, inclusion and people development, without the general ESG Diversity and Inclusion scores (Fig. 4), configured to test the second research hypothesis (H2). Therefore, for each combination of selected indicators and for each set of SEM configurations, the focus is on identifying the role played by the employee diversity, inclusion and development for socially responsible management strategies and financial performance of companies in Europe.

Moreover, to provide robust and accurate results, the SEM models are processed through the Maximum Likelihood Estimator (MLE) with missing values, based on the iterations associated with this method, so as the final estimations are accurate, reliable and relevant for the empirical analysis performed. Accordingly, this method gives unbiased parameter estimates and standard errors, since it computes the likelihood separately for those cases with complete data on some variables and those with complete data on all variables, being asymptotically efficient. Under the maximum likelihood, both imputation and analysis is done under a single model, this method allowing to test a complex pattern of relationships implied by the model.

Furthermore, for a double check of the results and accuracy of the relationships entailed in the case of structural equations, for each set of SEM configurations, we

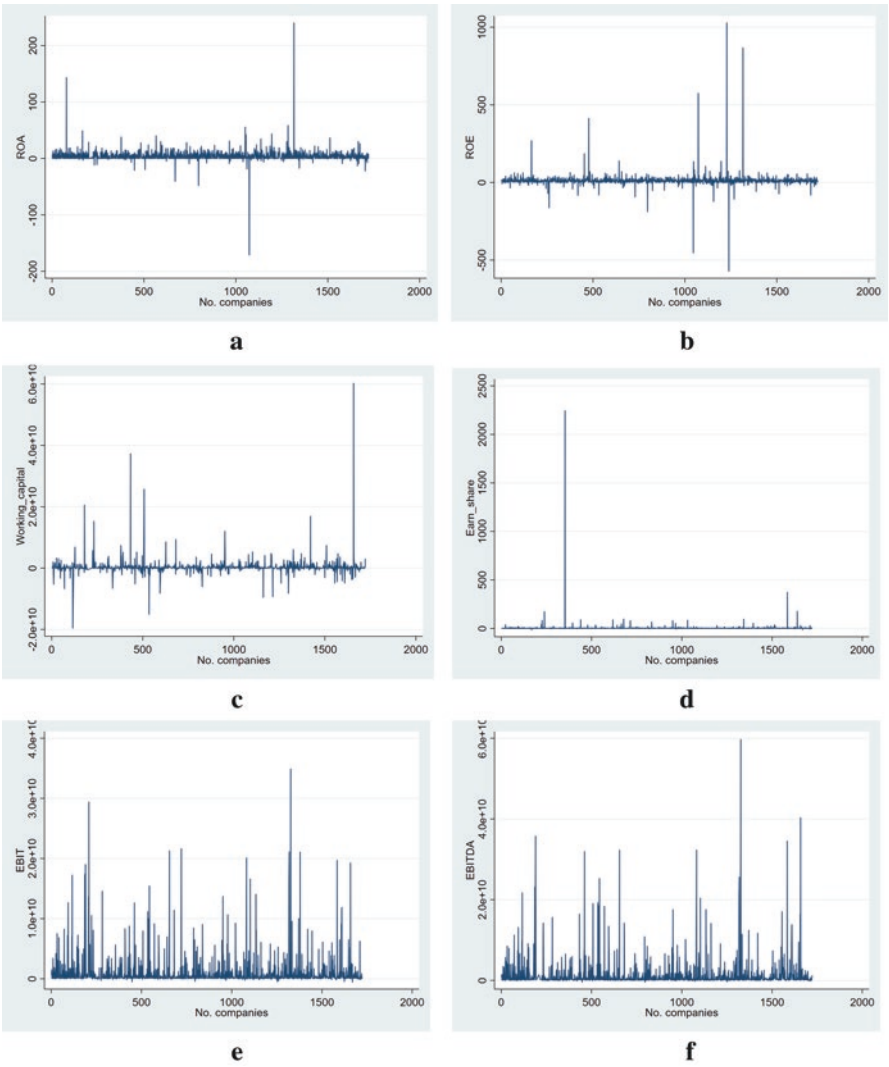

Fig. 2 Evolution of the financial performance indicators (**a**) *ROA*, (**b**) *ROE*, (**c**) *Working_capital*, (**d**) *Earn_share*, (**e**) *EBIT*, (**f**) *EBITDA*, across the 1722 companies from various industries comprised in the dataset. Source: own process of Thomson Reuters Eikon data (2020) in Stata 16

have configured a network analysis, namely a Gaussian Graphical Model (GGM), estimated based on partial correlations (the classical approach that relies on finding the pairs of variables with nonzero partial correlation coefficients in the construction of the Gaussian graphical network). GGMs are modern techniques of data analysis and are frequently used to explore networks across a set of variables thus allowing us to explore in depth the relationships between employee diversity,

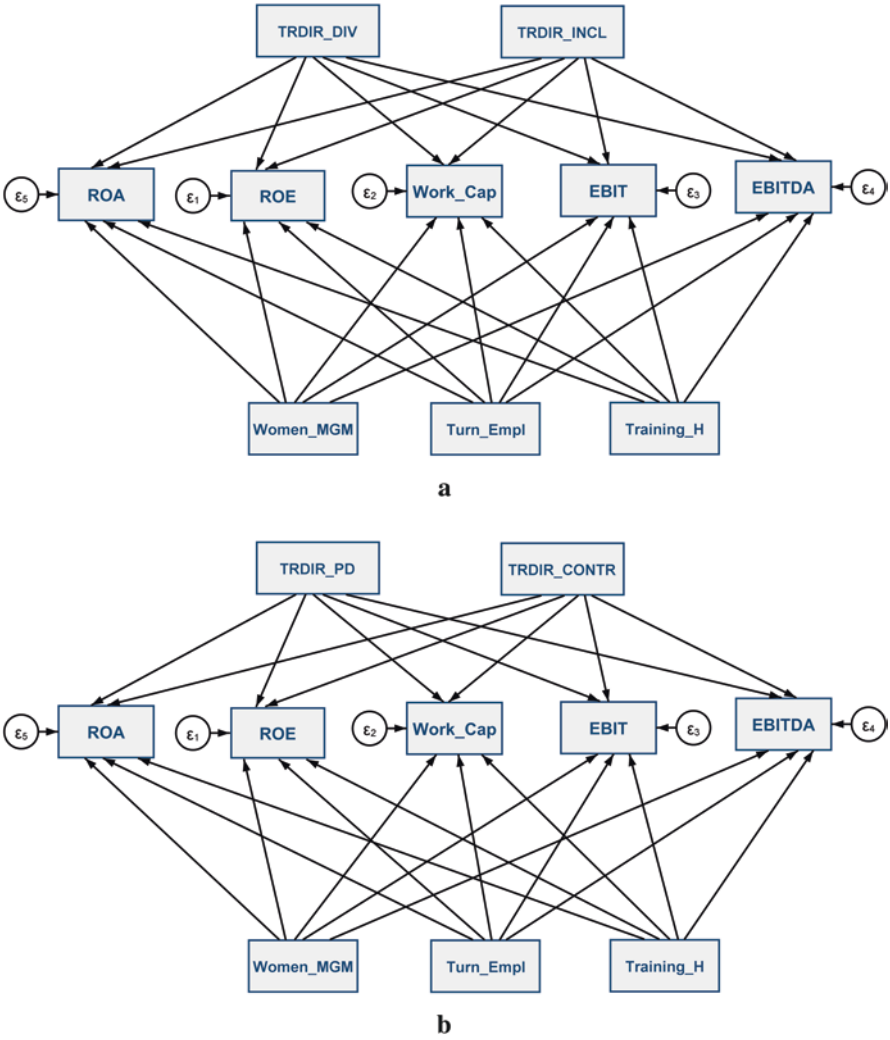

Fig. 3 General configuration of the first set of structural equation models (SEM 1), considering human capital indicators and (**a**) ESG diversity and inclusion, respectively (**b**) ESG People development and News and Controversies, designed to test H1. Source: authors' own research

inclusion and human capital development and the financial performance of European companies.

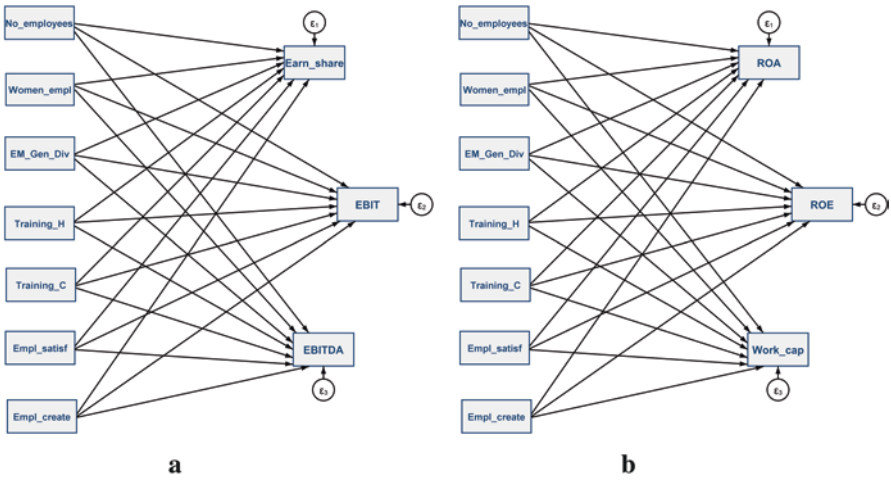

Fig. 4 General configuration of the second set of structural equation models (SEM 2), considering (**a**) *Earn_share, EBIT* and *EBITDA*, respectively (**b**) *ROA, ROE* and *Work_cap*, configured to test H2. Source: authors' own research

4 Results

The first set of results obtained after processing the SEM models designed as in Fig. 3 to test the first research hypothesis (H1), through the MLE method, are entailed in Fig. 5 and detailed in the Appendix, Table 2.

According to the estimations, the ESG diversity pillar (*TRDIR_DIV*) leads to important benefits for the companies considered in our dataset since additional efforts made for increasing the diversity within these companies significantly increases the return on equity, *ROE* (positive estimated coefficient of 0.142, statistically significant at the 1% level), as well as the level of the working capital (positive estimated coefficient of 0.965, statistically significant at the 0.1% level), the level of *EBIT* (positive estimated coefficient of 1.057, statistically significant at the 1% level) and *EBITDA* (positive estimated coefficient of 1.118, statistically significant at the 1% level). Positive implications are generated also in terms of *ROA* (positive estimated coefficient of 0.042, yet with a lower degree of statistical significance). The results are in line with those obtained by Khan et al. (2017)—considering ROE for financial performance, but also Reguera-Alvarado et al. (2017) and Erhardt et al. (2003)—enclosing *ROA* as a measurement unit for the financial performance.

At the same time, the ESG inclusion pillar (*TRDIR_INCL*) entails beneficial influences on the efficiency of the companies in Europe considered for the analysis, since an increase in the inclusion efforts made by these companies lead to increases in *ROE*, *Working_capital*, *EBIT, EBITDA* (positive estimated coefficients, statistically significant), while in the case of *ROA*, the results are inconclusive, since the estimated coefficient is statistically insignificant. The results are opposite to those obtained by Lips (2018) that revealed unfavorable influence on

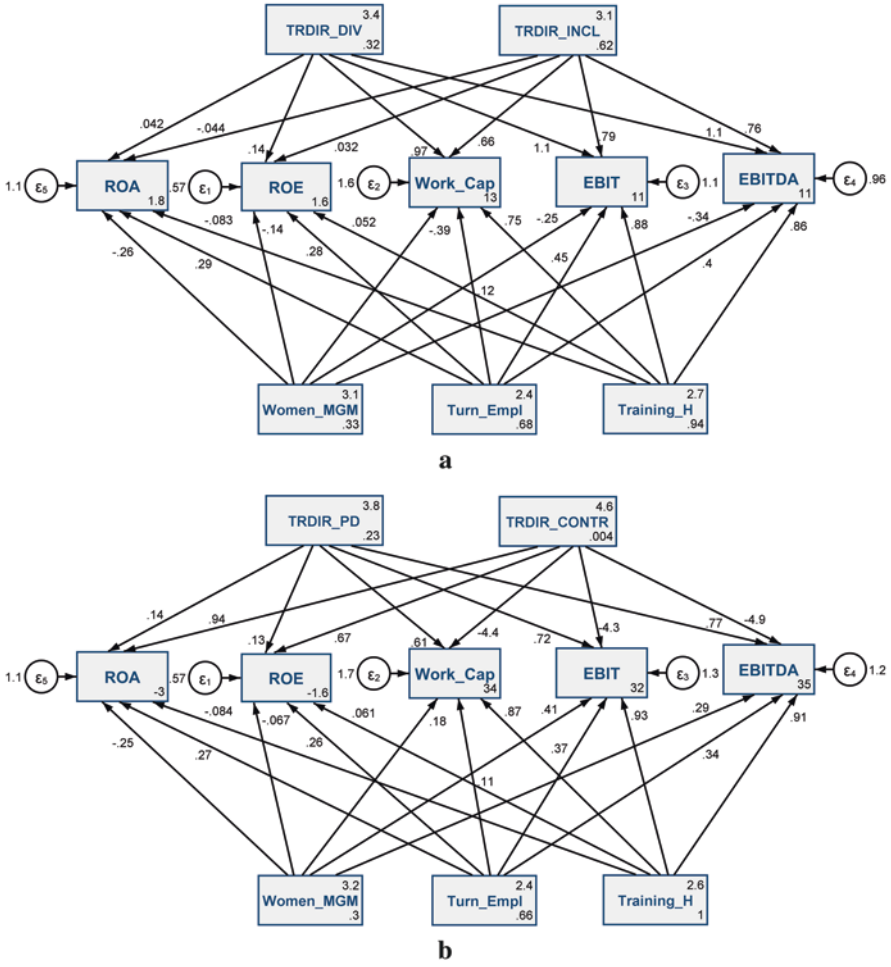

Fig. 5 Results of the first set of structural equation models (SEM 1), considering human capital indicators and (**a**) ESG diversity and inclusion, respectively (**b**) ESG People development and News and Controversies (H1). Source: authors' own research in Stata 16

financial performance (measured by *ROA*) in the case of inclusion on the workplace of particular categories of people (with dissabilities).

The same positive effects are accounted by the people development ESG dimension (*TRDIR_PD*), including in terms of *ROA* (even though with a lower statistical significance of the estimated coefficient).

An increase in controversies (*TRDIR_CONTR*) induces significant decreases in *EBIT* (negative estimated coefficient of −4.278, statistically significant at 0.1% threshold) and *EBITDA* (negative estimated coefficient of −4.859, statistically significant at 0.1% threshold), as well as in the level of the working capital (negative estimated coefficient of −4.392, statistically significant at 0.1% threshold). Positive

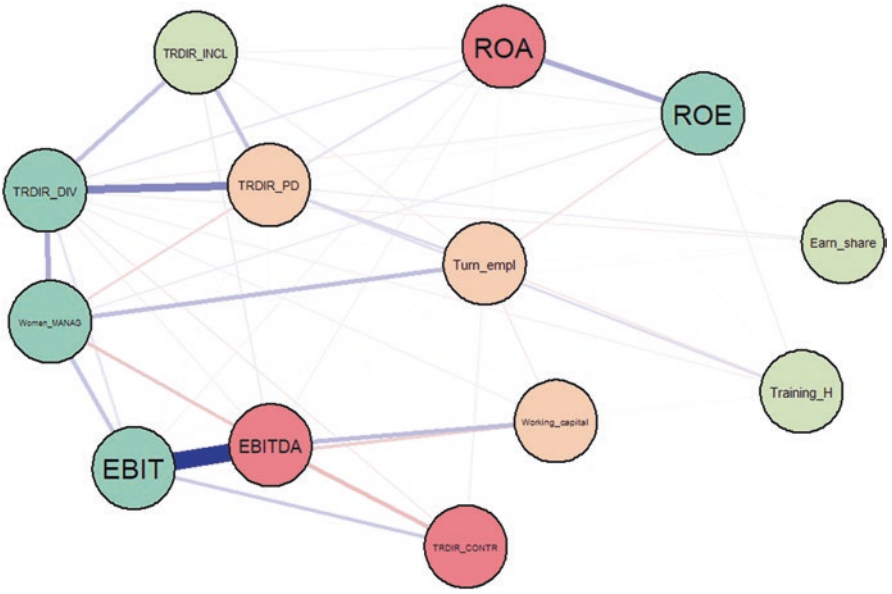

Fig. 6 GGM network configured for the variables associated with SEM 1 (H1). Source: authors' own research in R

coefficients are associated with *ROA* and *ROE*, but in this case the degree of statistical significance is significantly lower. Rodríguez-Fernández et al. (2019) have revealed the same favorable influence of the controversies variable (ESGC) on financial performance, measured by ROA and ROE for the data extracted from Thomson Reuters database at the level of 2017.

When we have established this setting in a network analysis through a Gaussian Graphical Model, we have noticed that the three ESG pillars related to diversity (*TRDIR_DIV*), inclusion (*TRDIR_INCL*) and human capital development (*TRDIR_PD*) are closely related to *ROA* and *ROE*, while the controversies (*TRDIR_CONTR*) dimension is strongly related to *EBIT, EBITDA* and working capital, as entailed by Fig. 6.

Hence, the first research hypothesis, *H1: There are significant interlinkages between the four basic ESG pillars (gender diversity, inclusion, people development and controversies) jointly with key human capital credentials and the financial performance of the European companies considered,* is fulfilled.

We have completed our research endeavor targeted to assess the impact of employee diversity, inclusion and professional development on the financial performance (profitability, efficiency) of companies having the headquarters in Europe with the second set of SEM and GGM. These models are designed to include only separate coordinates of the ESG pillars and key human capital credentials, individually captured as components from the ESG indices previously considered. Hence, we took into account the employment creation, number of total employees, the

share of women employees and executive members gender diversity (for the gender dimension of diversity), along with employee satisfaction, training hours and training costs, all of these elements being essential in shaping the financial outcomes and performance of a company. The results obtained after processing the second set of SEM models through the MLE method with missing values, designed to test the second research hypothesis (H2), are presented in Fig. 7 and detailed in the Appendix, Table 3.

These final estimations offer a deeper understanding on the role played by the human capital in shaping responsible strategies of companies, by targeting increased financial results at the same time. Hence, an increased number of employees and particularly women employees and a higher rate of employment creation lead to significant increases in *ROA*, *ROE* and earnings per share (*Earn_share*). Positive implication in terms of *ROA* and *ROE* are also induced by increased training hours and training costs associated with the efforts made by the company to improve the knowledge, skills and capabilities of their employees, with enhanced beneficial spillovers on financial performance and profitability. At the same time, a high level of employees' satisfaction positively and decisively reverberates on the financial performance of companies in Europe considered for the empirical analysis (positive estimated coefficients, statistically significant). Same results were obtained by Pang and Lu (2018) and Park (2020) as regards favorable implications of employee job satisfaction on financial performance, and Johnson et al. (2019) considering gender diversity (higher women employees), jointly with ethnic and cultural diversity.

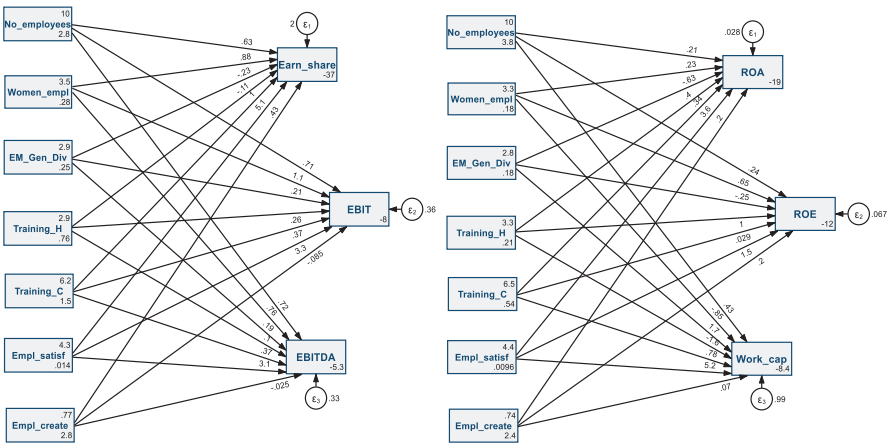

Fig. 7 Results of the second set of structural equation models (SEM 2), considering (**a**) *Earn_share, EBIT* and *EBITDA*, respectively (**b**) *ROA, ROE* and *Work_cap* (H2). Source: authors' own research in Stata 16

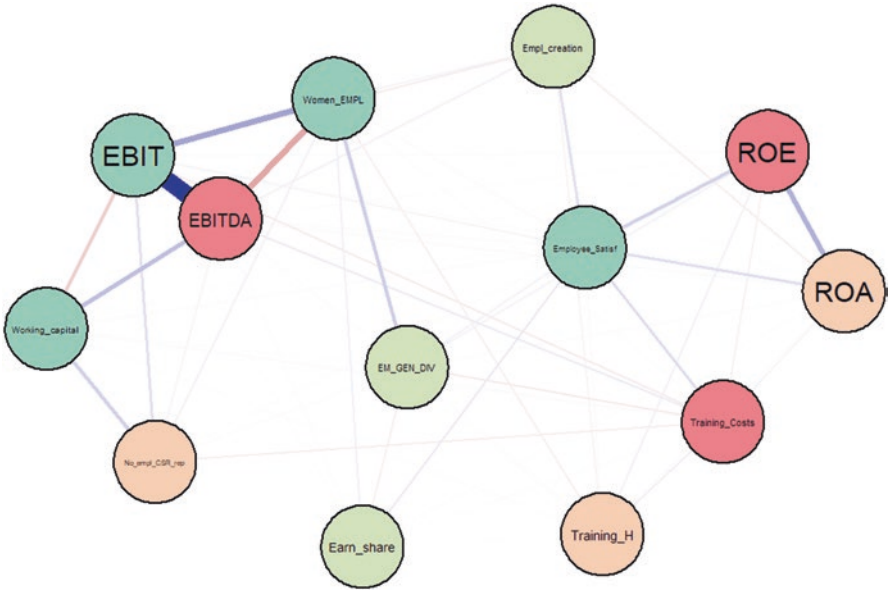

Fig. 8 GGM network configured for the variables associated with SEM 2 (H2). Source: authors' own research in R

We have further placed these variables in a single setting to design the network analysis through another GGM with partial correlations. The resulting network is presented in Fig. 8.

The GGM entails that *ROA* and *ROE* are directly linked to employee satisfaction, training costs and employment creation (essentially shaped by the people development dimension), while *EBIT*, *EBITDA* and the working capital is directly linked to the total number of employees, as well as women employees and executive management gender diversity. Accordingly, the financial performance is significantly shaped by the diversity dimension, as Johnson et al. (2019) also proved.

Therefore, the second research hypothesis, *H2: There are significant connections between several human capital dimensions and individual indicators reflecting diversity, inclusion and people development (without the general ESG Diversity and Inclusion pillars) and the financial performance of the European companies considered,* is fulfilled.

5 Discussion

The ESG diversity credentials bring several important benefits for the companies considered in our dataset when additional efforts are made to increase diversity within these companies, thus contributing to significant upturns in firms' profitabil-

ity and performance. Own results and a vast body of research document the relationship between diversity and improved financial performance of companies from various industries. They evidence that an increased number of employees and particularly women employees and a higher rate of employment creation lead to significant increases in the fundamental financial performance indicators. In terms of gender, while there is plenty more to do, some companies have significantly enhanced average diversity and women representation in executive boards. Our empirical research sheds light on how companies can enhance diversity as an enabler of business performance, by creating new opportunities and transforming the decision-making process.

Human capital plays an essential role in shaping company responsible strategies, by targeting increased financial results at the same time, while diversity at the workplace represents a key milestone that needs to be accounted by firms and therefore opens a new debate on how companies can ensure a solid sustainable growth based on the intellectual capital embedded in deployed activities.

Along with the diversity and inclusion essentials, increased training hours and training costs, associated with the efforts made by the company to improve the knowledge, skills and capabilities of their employees, have proved to induce enhanced beneficial spillovers on the financial performance and firm profitability.

Also, a high level of employees' satisfaction and engagement positively and decisively reverberate on the financial performance of companies from Europe, considered in this empirical analysis. Hence, companies should account for comprehensive strategies to encourage and facilitate full participation of employees at targeted activities deployed within the company, in order to benefit from an increased labor productivity and overall firm performance.

6 Conclusion

Based on our research results, we infer that responsible investment strategies made by the companies on each environmental, social and governance (ESG) dimension induce sustainable yields for investors, jointly with advanced risk management decisions (given by multiple combinations of ESG factors). Thereby, our research endorses and boosts the literature underpinnings with complex and accurate results of the interlinkages between ESG pillars (gender diversity, inclusion, people development and controversies) with financial performance and European companies' profitability. Financial performance is appraised by standard indicators, namely *ROA, ROE*, and firms' profitability by *EBIT, EBITDA*, earnings per share and working capital.

The two sets of SEM models were configured to assess the two research hypotheses advanced in our research design. The first set comprised the ESG pillars jointly with three human capital key coordinates (namely, women managers, training hours paid by the employer and employees' turnover), while the second one centered only on several human capital dimensions and individual indicators reflecting diversity,

inclusion and people development, without the general ESG D&I scores. Both sets of results revealed significant interlinkages among these indicators and the financial performance and profitability of considered companies from Europe. Therefore, main results bring to the fore that human capital is essential for company financial performance, employee and executive management gender diversity and people development (number of employees and particularly women employees, training hours, training allocations/costs, employee satisfaction) being the main dimensions that have proved to reduce the financial risk and enhance firm profitability. Moreover, ESG diversity, inclusion and people development credentials have positive effects on firm outputs, while ESG controversies pillar induces unfavorable impacts.

As regards the each ESG pillar's for management decisions, according to specific GGMs, three ESG pillars related to diversity, inclusion and human capital development are related to financial performance (*ROA* and *ROE*), while the controversies pillar to companies' profitability *(EBIT, EBITDA* and working capital). Financial performance is directly connected to employee satisfaction, training costs and employment creation (included on people development dimension), while profitability is mostly linked to the total number of employees, women employees, as well as executive management gender diversity.

The limitations of our research may rely on the missing data in companies' CSR reports and the subjectivity of measurements (e.g., scores, binary data given by answers—true/false, yes/no). Our future research is addressed to examine the Brexit effects upon companies with the headquarters in Europe, considering the research of Pirtea et al. (2014), with a specific focus on firm competitiveness, as well as to capture the impacts of each ESG diversity and inclusion pillar (namely, gender and cultural diversity, inclusion, professional development of employees and controversies) on distinctive financial performance and firms' profitability (various proxies), in order to identify targeted strategies for each component.

Appendix

Table 2 Detailed results of the SEM models designed to assess the impact of employees' dimension jointly with the ESG D&I pillars on companies' financial performance

Variables	SEM 1	SEM 2
log_ROE		
log_TRDIR_DIV	0.142**(0.0489)	
log_Women_MGM	−0.138*(0.0560)	−0.0665(0.0549)
log_Turn_empl	0.277***(0.0372)	0.257***(0.0401)
log_TRDIR_INCL	0.0325(0.0346)	
log_Training_H	0.0522(0.0299)	0.0613*(0.0269)
Log_TRDIR_PD		0.129**(0.0478)
log_TRDIR_CONTR		0.667*(0.302)
_cons	1.551***(0.227)	−1.602(1.411)

(continued)

Table 2 (continued)

Variables	SEM 1	SEM 2
log_Working_capital		
log_TRDIR_DIV	0.965***(0.114)	
log_Women_MGM	−0.393**(0.121)	0.175(0.128)
log_Turn_empl	0.120(0.0900)	0.110(0.105)
log_TRDIR_INCL	0.660***(0.0746)	
log_Training_H	0.750***(0.0607)	0.875***(0.0574)
log_TRDIR_PD		0.606***(0.116)
log_TRDIR_CONTR		−4.392***(0.904)
_cons	12.90***(0.513)	34.09***(4.206)
log_EBIT		
log_TRDIR_DIV	1.057***(0.0890)	
log_Women_MGM	−0.251**(0.0967)	0.405***(0.103)
log_Turn_empl	0.447***(0.0595)	0.366***(0.0768)
log_TRDIR_INCL	0.793***(0.0426)	
log_Training_H	0.880***(0.0379)	0.932***(0.0386)
log_TRDIR_PD		0.723***(0.0817)
log_TRDIR_CONTR		−4.278***(0.500)
_cons	10.76***(0.373)	31.79***(2.340)
log_EBITDA		
log_TRDIR_DIV	1.118***(0.0863)	
log_Women_MGM	−0.344***(0.0947)	0.290**(0.105)
log_Turn_empl	0.398***(0.0597)	0.338***(0.0771)
log_TRDIR_INCL	0.761***(0.0420)	
log_Training_H	0.855***(0.0369)	0.913***(0.0375)
log_TRDIR_PD		0.767***(0.0786)
log_TRDIR_CONTR		−4.859***(0.486)
_cons	11.47***(0.365)	35.10***(2.273)
log_ROA		
log_TRDIR_DIV	0.0425(0.0783)	
log_Women_MGM	−0.265***(0.0803)	−0.248**(0.0787)
log_Turn_empl	0.288***(0.0555)	0.272***(0.0590)
log_TRDIR_INCL	−0.0440(0.0523)	
log_Training_H	−0.0834(0.0454)	−0.0842*(0.0419)
log_TRDIR_PD		0.140(0.0768)
log_TRDIR_CONTR		0.945*(0.448)
_cons	1.842***(0.360)	−3.019(2.082)
/		
mean(log_*TRDIR_DIV*)	3.351***(0.0140)	
mean(log_*Women_MGM*)	3.126***(0.0210)	3.204***(0.0185)
mean(log_*Turn_empl*)	2.390***(0.0335)	2.383***(0.0326)
mean(log_*TRDIR_INCL*)	3.109***(0.0281)	

(continued)

Table 2 (continued)

Variables	SEM 1	SEM 2
mean(log_*Training_H*)	2.685***(0.0358)	2.629***(0.0344)
var(e.log_*ROE*)	0.568***(0.0235)	0.573***(0.0235)
var(e.log_*Working_capital*)	1.586***(0.0884)	1.677***(0.0936)
var(e.log_*EBIT*)	1.056***(0.0484)	1.338***(0.0584)
var(e.log_*EBITDA*)	0.959***(0.0458)	1.215***(0.0550)
var(e.log_*ROA*)	1.107***(0.0497)	1.109***(0.0495)
var(log_*TRDIR_DIV*)	0.323***(0.0112)	
var(log_*Women_MGM*)	0.331***(0.0187)	0.297***(0.0142)
var(log_*Turn_empl*)	0.681***(0.0407)	0.660***(0.0395)
var(log_*TRDIR_INCL*)	0.623***(0.0330)	
var(log_*Training_H*)	0.943***(0.0584)	1.046***(0.0643)
cov(log_*TRDIR_DIV*,log_*Women_MGM*)	0.133***(0.0160)	
cov(log_*TRDIR_DIV*,log_*Turn_empl*)	0.0100(0.0221)	
cov(log_*TRDIR_DIV*,log_*TRDIR_INCL*)	0.0494*(0.0193)	
cov(log_*TRDIR_DIV*,log_*Training_H*)	0.0174(0.0242)	
cov(log_*Women_MGM*,log_*Turn_empl*)	0.0686***(0.0192)	0.0759***(0.0179)
cov(log_*Women_MGM*,log_*TRDIR_INCL*)	0.0262(0.0170)	
cov(log_*Women_MGM*,log_*Training_H*)	−0.0292(0.0231)	−0.0604**(0.0223)
cov(log_*Turn_empl*,log_*TRDIR_INCL*)	−0.0516*(0.0252)	
cov(log_*Turn_empl*,log_*Training_H*)	−0.189***(0.0346)	−0.213***(0.0362)
cov(log_*TRDIR_INCL*,log_*Training_H*)	−0.00513(0.0270)	
mean(log_*TRDIR_PD*)		3.754***(0.0127)
mean(log_*TRDIR_CONTR*)		4.594***(0.00156)
var(log_*TRDIR_PD*)		0.233***(0.00873)
var(log_*TRDIR_CONTR*)		0.00403***(0.000140)
cov(log_*TRDIR_PD*,log_*Women_MGM*)		−0.00175(0.00977)
cov(log_*TRDIR_PD*,log_*Turn_empl*)		0.00762(0.0167)
cov(log_*TRDIR_PD*,log_*TRDIR_CONTR*)		−0.00156*(0.000757)
cov(log_*TRDIR_PD*,log_*Training_H*)		0.0345*(0.0170)
cov(log_*Women_MGM*,log_*TRDIR_CONTR*)		0.000427(0.000993)
cov(log_*Turn_empl*,log_*TRDIR_CONTR*)		0.00324*(0.00149)
cov(log_TRDIR_CONTR,log_Training_H)		−0.0000619(0.00183)
N	1710	1714

Standard errors in parentheses, $^{*}p < 0.05$, $^{**}p < 0.01$, $^{***}p < 0.001$
Source: authors' research

Table 3 Detailed results of the SEM models designed to assess the impact of employees' dimension on companies' financial performance

Variables	SEM (1)	SEM (2)
Log_Earn_share/log_ROA		
log_Women_empl	0.882(0.683)	0.227(0.205)
log_Training_H	−0.106(0.459)	0.404*(0.197)
log_Training_C	1.023**(0.389)	0.335*(0.150)
log_EM_gen_div	−0.233(0.698)	−0.635***(0.171)
log_Empl_satisf	5.127(3.124)	3.598***(0.810)
log_Empl_creation	0.426(0.232)	0.201***(0.0508)
log_No_empl_CSR_rep	0.633*(0.258)	0.208***(0.0567)
_cons	−36.60*(16.17)	−18.79***(4.557)
log_EBIT		
log_Women_empl	1.101***(0.292)	
log_Training_H	0.259(0.196)	
log_Training_C	0.371*(0.166)	
log_EM_gen_div	0.211(0.299)	
log_Empl_satisf	3.279*(1.337)	
log_Empl_creation	−0.0847(0.0995)	
log_No_empl_CSR_rep	0.708***(0.110)	
_cons	−8.021(6.918)	
log_EBITDA		
log_Women_empl	0.760**(0.279)	
log_Training_H	0.105(0.188)	
log_Training_C	0.365*(0.159)	
log_EM_gen_div	0.195(0.286)	
log_Empl_satisf	3.091*(1.279)	
log_Empl_creation	−0.0247(0.0951)	
log_No_empl_CSR_rep	0.720***(0.105)	
_cons	−5.268(6.617)	
/		
var(e.log_Earn_share)	1.989**(0.629)	
var(e.log_EBIT)	0.364**(0.115)	
var(e.log_EBITDA)	0.333**(0.105)	
var(e.log_ROA)		0.0280*(0.0125)
var(e.log_ROE)		0.0670*(0.0300)
var(e.log_Working_capital)		0.992*(0.444)
log_ROE		
log_Women_empl		0.646*(0.317)
log_Training_H		1.016***(0.305)
log_Training_C		0.0290(0.232)
log_EM_gen_div		−0.249(0.264)
log_Empl_satisf		1.498(1.253)
log_Empl_creation		0.205**(0.0786)

(continued)

Table 3 (continued)

Variables	SEM (1)	SEM (2)
log_No_empl_CSR_rep		0.240**(0.0877)
_cons		−11.61(7.054)
log_Working_capital		
log_Women_empl		−0.846(1.220)
log_Training_H		−1.559(1.175)
log_Training_C		0.779(0.892)
log_EM_gen_div		1.718(1.017)
log_Empl_satisf		5.239(4.823)
log_Empl_creation		0.0697(0.302)
log_No_empl_CSR_rep		0.425(0.338)
_cons		−8.393(27.15)
N	1710	1714

Standard errors in parentheses, $^{*}p < 0.05$, $^{**}p < 0.01$, $^{***}p < 0.001$
Source: authors' research

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An Enterprise Risk Management (ERM) Maturity Index for European Airports

Marnick Gatt, Simon Grima, and Yannis E. Thalassinos

Abstract An ERM maturity assessment would support the development of an ERM process which will help Airports improve their capabilities to anticipate, manage and possibly turn risks into opportunities. The purpose of this study is to investigate and identify the best practices that represent ERM maturity in the business context of a European airport and to develop an ERM Maturity Index as a resource to assess and evaluate their ERM implementation. Structured interviews with ten airport risk management practitioners and consultants were conducted. Data generated from these interviews attested to twenty-two applicable ERM best practices, which were divided into eight categories. Following the development of the proposed maturity index, a case study was created and conducted in order to illustrate the use and interpretation of the resulting information. Results show senior management commitment, an optimum communication process, and well defined ERM roles and responsibilities. These are the three most crucial factors for airports to achieve a high degree of ERM maturity. Moreover, the study's hypothesis that the best practices representing ERM maturity at organizations operating in the financial

This chapter is based on an unpublished thesis by Gatt, M. titled "Developing an ERM Maturity Index For European Airports", in the Faculty of Economics, Management and Accountancy, University of Malta, supervised by Dr. Simon Grima. It is properly adjusted and extended for the purpose of this volume.

The original version of this chapter was revised. The correction to this chapter is available at https://doi.org/10.1007/978-3-030-67020-7_20

M. Gatt
Faculty of Economics, Management and Accountancy, University of Malta, Msida, Malta

S. Grima (✉)
Faculty of Economics, Management and Accountancy, Department of Insurance, University of Malta, Msida, Malta
e-mail: simon.grima@um.edu.mt

Y. E. Thalassinos
Faculty of Economics, Management and Accountancy, Department of Insurance, University of Malta, Msida, Malta

GUST, University of Kuwait, Kuwait, Kuwait

K. Nermend et al. (eds.), *Decision-Making in Management*, Contributions to Management Science, https://doi.org/10.1007/978-3-030-67020-7_18

and insurance industries are equally applicable for European airports, was contradicted following the exclusion of two non significantly applicable best practices.

Keywords Enterprise risk management (ERM) · European airports · Maturity · Risk assessment · Best practices

1 Introduction

Risk, as a term, often carries a negative connotation. As human beings, we are likely to associate risks with situations that would be better avoided, or current threats that we hope will not materialise. In the context of a business environment however, risk can be considered as something inseparable from business ventures who seek further growth and improvement in their financial performance. To this end, rather than being desirable or undesirable, risk is crucial for the existence of an organization to make profits (Lamb 2007).

As Drucker et al. (2015) once said, "a decision that does not involve risk is probably not a decision". To be successful, every business venture needs to understand the risks entailed, which are crucial to the survival of their venture. In Against the Gods: The Remarkable Story of Risk (1996), Bernstein presented a comprehensive overview of human efforts in their quest to understand risk and the probability for it to materialize. He explained the efforts made by early gamblers in ancient Greece and moved on by recounting the events of the seventeenth century made by Pascal and Fermat up to modern methodology, which is referred to as The Chaos Theory. Bernstein shows that understanding risk is part of every successful endeavour, starting from the game theory to bridge-building and winemaking. Arguably, the stakes for understanding risk in today's business environment have never been greater as globalisation and economic climate change have greatly accelerated business volatility and risk (Behrendt and Khanna 2003). Related research on Chaos Theory has been published in several fields (Thalassinos et al. 2009, 2012, 2013; Hanias et al. 2007).

The rapid upsurge in competition in the business environment has led businesses to face an increase in uncertainties resulting from an increase in risks as well as opportunities as organizations strive to remain competitive through value creation for their consumers. To keep themselves competitive, over the years various popular organizations had to take several essential measures. Certain organizations such as the Danish brewer Carlsberg had terminated 2000 jobs to cut their costs and improve earnings following reports that showed that they were making substantial losses due to their struggle to beat competition raising form Russian and Chinese markets (Zander 2015). Other organizations had to shut down part of their offices, branches, divisions, or plants due to radical reductions in the demand for their products or services; a case in point is the Japanese electronics company Sharp which had to close down four manufacturing plants as well as exiting or selling the company's money-losing solar panel business in a bid to improve their fading fortune (Nikkei

2015). Such events have led to an increase in interest concerning corporate governance and risk management that has moved up the stakeholders' agendas.

The AON 2015 Global Risk Management Survey provides an insight into the facts and figures collected from 1418 organizations around the world. The study was conducted to establish the top overall risks facing global organizations of any size and industry sector. Their findings have demonstrated that for the last 5 years, risks in the business environment have continued to evolve. While 'economic slowdown' or 'slow recovery' was considered as the most prominent risk facing worldwide organizations since 2009, it has now been overtaken by several other daunting challenges presented by both internal and external global business environment.

Emerging risks associated with the use of information technology such as cybersecurity have gained importance while traditional risks such as brand reputation damage and increase in the competition are getting more complex as they are taking new dimensions. This constant evolution of risks and challenges has made corporate risk management a necessity for organizations to survive. Enterprise-wide risk management is now being considered as a key component for business success (AON 2015).

1.1 Enterprise Risk Management (ERM) Concept

Risks have always been an integrated part in the business environment and as risks continued to evolve, organizations started looking at ways to implement some sort of a formal risk management framework as a setup to manage their risks and maximise their opportunities. Public and private organizations operating in various industries started to identify risk management aspects that can benefit their organization. Since the mid-1990s, ERM has emerged as an organised and integrated process for holistic management of risks facing the organization (Geneva 2011).

One of the most cited definitions of ERM is that of (COSO 2004, p. 2) which defines ERM as:

> A process, effected by the entity's board of directors, management, and other personnel, applied in strategy setting and across the enterprise, designed to identify potential events that may affect the entity, and manage risk to be within the risk appetite, to provide reasonable assurance regarding the achievement of entity objectives.

For the purpose of this research, the authors define ERM as a risk management technique based on a framework that enables a continuous process by which organizations can effectively identify, analyse and mitigate risk exposure across the whole organization. The literature review shows that this risk management framework can vary between organizations, depending on the size and resources, but naturally, it involves procedures, employees, and tools. In a typical setup, a selected group of individuals will be assigned responsibilities to follow established processes and procedures combined with appropriate tools and technology to manage risks within their organization (Kreiser 2013; Rupeika-Apoga et al. 2018; Ugurlu et al. 2014).

Such a structured organization-wide risk management approach differs from the traditional approach towards risk management (Polyakova et al. 2019). Over the last 10–15 years there was a paradigm shift in the way organizations perceived risk management. Traditionally, organizations used to analyse risk in narrow silos without taking into consideration the broader consequences of their departmental risk exposures for the whole organization (Thalassinos et al. 2015; Kupec 2018).

According to Deloitte's Global Risk Management Survey, which was conducted in 2011, the major challenges incurred when implementing an effective ERM program are the integration of the risk management process with the existing business processes across the whole organization and changes required to entrench risk management in the organizational culture (Deloitte 2011). The importance of senior management support and involvement is also highlighted in COSO's definition of ERM. Senior management needs to be thoroughly involved to gain awareness of the risks that can affect the strategies at both business and corporate levels. ERM is intended to serve as a key resource for senior management to help them make well-informed decisions (KPMG 2010).

The differentiating attribute of ERM lies in the alignment between risk management and the organizational strategy; such alignment steers the risk management process and the organizational strategy in the same direction as the organizational risk appetite.

During the execution of the organizational strategy, risks are continuously identified by taking into consideration the business objectives against the organization's risk appetite, which outlines the organization's tolerance toward risk (COSO 2004). The ultimate goal of ERM is not only to protect the organization but also to add value to the organization by providing the relevant information for an organization to exploit its business opportunities (Wang and Faber 2006).

A good implementation of the ERM framework offers numerous benefits to an organization as embedded risk awareness facilitates strategic and operational decisions resulting inadequate allocation of organizational resources and ultimately improved profitability (Buehler et al. 2008).

1.2 Risks and Challenges in the Airport Industry

The airport industry which has long been characterised by stability is now facing higher levels of risk and volatility. Regulators and airline tenants are intensifying the pressure to reduce airport charges, while at the same time, airport management is investing in huge airport development projects, which carry higher investment and project risks. As passengers expect higher levels of customer service, operational challenges increase and exert further pressure on airport costs.

In the current competitive environment, the traditional approach of raising airline fees as airport costs increases is not likely to work and for the foreseeable future, airport management will continue to face added levels of uncertainty and strategic risks. A one-size-fits-all approach does not work, so airport managers must improve

their capabilities to anticipate and manage and turn risks into opportunities to improve airport profitability. Some European airports are looking at opportunities to generate revenues from non-aviation areas such as retail, services and real estate through expensive terminal expansions (Mercer et al. 2008). Due to its worldwide importance, the airport industry is naturally a high-risk industrial operation with the assurance of passengers' safety at the top of every airport's risk mitigation priorities.

Over the years airports became an important component of both national and international transportation network, contributing considerably to every country's direct and indirect economy. Incidents such as the recent terrorist attack at Brussels 'airport has shown the catastrophic effects that such threats can have on an individual's safety, regional economies, the wider aviation industry and the airport itself. In the airport industry, safety, operational and emergency risk management systems have been regulated for quite some time to ensure that risks associated with these activities are mitigated to a tolerable level and controlled should they materialise. Moreover, the current pandemic—COVID-19 has put a lot of pressure on the stability of airline and hence airport finances.

However, these standard risk management procedures which are adopted at all airports do not take into consideration strategic risks resulting from activity growth, industrial competition, reputation, customer experience, and only partially cater for shareholders' value. Senior management at leading airports within Europe is therefore exploring other forms of corporate risk management methodologies which will help increase confidence in their business operations and to address gaps which are not covered by the existing standalone risk management systems. By embedding ERM into their organizational culture, airports' senior management will gain a better understanding of their organization's wide risks and opportunities as well as the system, people and practices involved in the risk management process (Stark 2015).

1.3 The Research Problem

ERM has gained priority in the agendas of insurers, investors, regulatory bodies, academics and professionals. Despite the various frameworks, guidelines and principles developed in the field of enterprise risk management, research has shown that the airport industry still regards ERM as an unproven and emerging field where lack of important knowledge and risk management assessment tools exists (Marsh Risk Consulting 2014). Research related to the integration of ERM in the organizational culture is limited especially beyond the context of the financial and insurance industries (Ahmad and Izah 2011).

Research has shown that external pressures such as investors and insurers are pushing the need for effective ERM in the airport industry. However, airports are yet to fully consider risk management as a process that can support business processes and the achievement of their strategic objectives (Marsh Risk Consulting 2014).

ERM research about a complex and inherently high-risk sector such as that of airports offer an interesting field for research as it provides us with the opportunity

to discover the applicability and importance of some ERM best practices, which are useful for gauging ERM maturity primarily in the insurance and financial industries (Bezzina et al. 2014; Grima and Bezzina 2018).

Moreover, the integration of ERM with strategy and performance management is essential to assess the maturity of any organisation including airports. All organisations need to set a strategy, which can be periodically adjusted following performance testing for the ever-changing opportunities to create value and to ensure that objectives are met without any 'hiccups'. The integration of ERM across the organization increases the range of opportunities while taking timely consideration of both the positive and negative risks that may arise (Coso 2017).

Even though to date several universal ERM maturity models have been developed, they are often criticised as they fail to consider specific needs of an organization. Contingency theory perspective has been suggested for developing customised ERM systems, to enable organizations to experiment with innovative frameworks of ERM to match their specific needs (Kaplan and Mikes 2014; Grima 2012).

The above statement suggests the need to research to determine the specific airport risk management approach as further research is needed to help understand and assess the practical implementation of ERM in an organizational setup such as that of an airport.

This research study is intended to build on the existing literature related to ERM maturity in financial and insurance organization by developing a quantitative ERM Maturity Index specifically for European airports. Apart from the scarce literature regarding ERM specifically in the context of a European airport, the previous ERM maturity models adopted primarily a qualitative approach to assess the degree of ERM integration within the business process. The quantitative approach of the proposed maturity index offers an immediate indication of the strengths and weaknesses within the airport risk management setup while risk managers will be able to score themselves and compare against their previous scores to identify their advancements and determine areas that need to be improved. Moreover, risk managers can compare their airport's risk management program score against other airports having the same operating characteristics such as airport location and an annual volume of passengers' traffic.

1.4 Research Aims and Objectives

Based on the rationale outlaid in the previous section, one can conclude that further research in the area of ERM maturity assessment can benefit the airport industry, as well as contribute to existing literature. As such this research aims to investigate airports' approach towards risk and risk management to identify the best practices that represent a mature ERM implementation within an airport. To investigate the maturity of an enterprise-wide risk management framework in these organizations, the research study will focus on capturing data concerning the risk management process, risk cultures and risk strategies that these airports have in place.

1.5 Research Questions

In this study we aimed to answer the following three research questions:

1. Which are the key best practices that represent ERM maturity?
2. Which of the identified 'best practices' are applicable in the business context of an airport within Europe?
3. What is the relative importance of each 'best practices' in the business context of a European airport?

1.6 Hypothesis

H_0: A set of ERM best practices that represent ERM maturity at companies operating in the financial and insurance industries are equally applicable to European airports.

H_1: A set of ERM best practices that represent ERM maturity at companies operating in the financial and insurance industries are not equally applicable to European airports.

2 Literature Review

Although this literature review draws on multiple sources, priority was given to academic publications. Nevertheless, ERM is relatively a new field of study (Lam 2014).

2.1 The Evolution of ERM

According to D'Arcy (2001), the foundation of traditional risk management was developed in the 1950s when risks started to be managed mainly by insuring company assets. The first risk management literature entitled 'Risk Management in the Business Enterprise' emerged after 6 years of development by Mehr and Hedges in 1963. The major contribution to this literature was the introduction of the risk management concept that developed the idea of managing risks more broadly rather than simply ensuring against an uncertain loss or financial crisis. At that time the primary objective of risk management was to lessen the impact of probable and speculative risks and "to maximize the productive efficiency of the enterprise" (Mehr and Hedges 1963; Lam 2014).

In the 1970s, the instability of exchange rates and high inflation led to the development of the financial risk management concept (D'Arcy 2001). Later on, as multinational organizations started exporting their products and dealing with

foreign countries of different cultures and trade regulations, investors and the same organizations identified the need to address the consequent emergence of new types of risks. As stated by D'Arcy (2001), during the same period, the risk management concept continued to expand its scope to incorporate political risks which, at that time, were not being addressed through the proper use of risk management tools and techniques.

In the 1990s, the risk management concept continued to expand and incorporate emerging risks, such as those associated with evolving environmental regulations and the increased reliance on the internet as a business tool to build and maintain relationships with customers and suppliers. As the business environment continued to evolve, businesses were continuously being exposed to new types of risks, which they identified and mitigated to sustain their growth and competitive advantage. As Shenkir et al. (2002) noted at the beginning of the twenty-first Century, "As businesses worldwide enter the twenty-first century, they face an assortment of risks almost unimaginable just 10 years ago."

In 2004, COSO, a non-profit organization dedicated to providing guidance towards the introduction of ERM, issued what is known as the Enterprise Risk Management Integrated Framework. The latter is regarded as a set of best practice standards for organizations to implement ERM programs. The COSO framework provided a means for creating an organization-wide focus on risk management. According to Quinn and Richter (2005), between one third and a half of the companies that form the Fortune 500 companies, had introduced or were considering introducing ERM initiatives by the end of 2004.

While risk management was always considered as a means for organizations to safeguard their valuable assets, the introduction of the ERM concept marked a shift in the risk management paradigm and because of this, risk management is now being considered as an integral part of the enterprise strategy and encompassing an organization-wide risk management approach (Dionne 2013).

As explained by Barton et al. (2002) in their book "Making Enterprise Risk Management Pay Off", the risk management paradigm shift meant that while formerly strategic decisions were based on compliance, risk-mapping and risk mitigation (wherein there was no link between strategic and operational decisions and there was no involvement of different levels from within the organizations), the risk management evolution of the last decade has shifted its focus towards getting value through insights of key risks that may drive the company for profits or losses.

Crucially, risk management is a tool used to facilitate decision-making under uncertainty because it enables decision-makers to quantify the risk and decide on whether the risk that comes with that decision is in line with the company's risk appetite. As part of the latest risk management processes, board members meet personally with those in the company that has a leading perspective on the company's key risks, to address the critical questions about the risk capabilities of the company.

Further development on the original concept of ERM was stimulated by remarkable development in the business environment. As stated by Olson and Wu (2008), the development of ERM was mainly attributed to: Traumatic recent events such as 9/11 and business scandals such as Enron and WorldCom (Olson and Wu 2008).

As risk management is increasingly being embedded in the organization's strategy, the importance of risk management in the context of corporate governance has continuously increased. Ernst & Young while reviewing their research findings, which ultimately provided insight about current ERM governance, risk and compliance practices adopted by organizations operating in different industries, went as far as to conclude that:

> Risk is now becoming the fourth dimension of business. People were the first dimension. The process became the second dimension during the height of the manufacturing era. Evolving technology formed the third dimension. Embedded risk as the fourth dimension of business has the potential to fundamentally transform how organizations connect risk to reward (Ernst and Young Global Ltd 2014).

Moreover, although risk management is becoming increasingly embedded in the businesses' processes, it is yet also contributing additional value, which is changing the business culture from measuring the effectiveness of risk management by the level of activity, towards the implementation of risk management to measuring the performance of risk management through improvement of business results (Ernst and Young Global Ltd 2014). According to RIMS (2011), 80% of the organizations either have or are in the process of developing an ERM program, out of which 17% stated that their ERM programs are fully integrated and are addressing risks across the whole of their organization.

On the other hand, the results of a survey conducted by Marsh Risk Consulting (2014) which aimed to explore European Airport's approach to risk and risk management, showed that the airport's industry is yet to fully consider ERM as a process that can support the achievement of strategic objectives. Based on the results of these reports, it would seem that ERM is yet to be fully considered as a core business practice but it is being increasingly viewed as an indispensable tool for achieving organizational objectives.

2.2 Risk Management Frameworks

Risk management conceptual frameworks are seen as useful tools for the introduction or development of ERM initiatives within organizations. Organizations willing to introduce ERM, a risk management framework can be used as a roadmap to help them formulate a plan and the related processes. On the other hand, those organizations seeking to improve their current ERM processes, a risk management framework can serve as a tool to help assess their current ERM maturity and completeness and to identify areas which they might need to strengthen (Frigo and Anderson 2014).

COSO ERM Integrated Framework developed in 2004, and the ISO 31000 Risk Management Principles and Guidelines that were developed in 2009 are the two most widely risk management frameworks being referred to. These frameworks are intended to provide a structured portfolio of practices and a conceptual representation of what makes up ERM. Yet these risk management frameworks should not be considered as a "plug and play" tools, as each process needs to be assessed on

whether it contributes towards the achievement of the organization's objectives. Both ERM frameworks mentioned above must be tailored according to the organization's culture, type of risks, processes and style of management (Essaides 2013). As noted by professor Mikes, "Cultural theorists have shown us that risk means different things in different organizations, while experience tells us that a given risk model will work in some context and not in others" (Mikes 2012).

In other words, organizations should not attempt to implement a complete risk management framework religiously or blindly adopt risk management practices that worked in other organizations, since these may not fit the expectations and needs of one organization but not another.

The value within these risk management frameworks is in their use as a tool for management to think strategically about how risk management can provide as well as protect value for their organization. Within a risk, there is also an opportunity for organizations to take on the risk if it fits within the organization's risk appetite and contributes towards its objectives (Bekefi and Epstein 2008).

According to Frigo and Læssøe (2012),

> Risk management is not about risk aversion. If, or rather when, you want/need to take bigger chances than your competitors and get away with it you need to be better prepared. The fastest race cars in the world have the best brakes and the best steering to enable them to be driven faster, not slower. Risk management should enable organizations to take the risks necessary to grow and create value.

2.2.1 COSO ERM Framework

ERM is a continuous process directly related to corporate strategy and is applied across the entire organization. COSO's ERM framework identifies eight interrelated components which, combined with the organization's structure and objectives, can contribute towards a corporate competitive advantage (COSO 2004).

COSO's ERM framework is considered as a robust model as it incorporates all aspects for implementation; the three dimensions of the cubes shown above represent and display the relationships among the components of ERM and thus providing a "complete picture". The cube representation also facilitates addressing parts of the ERM framework during concept implementation as one can take on a slice through the cube and create a plan focused on addressing risks management of a particular business unit.

2.2.2 ISO 31000 Risk Management Framework

ISO 31000 is a generic framework for managing risks and like the COSO ERM framework, this framework was developed following extensive consultation and vetting by a group of risk management experts appointed specifically to study and make recommendations based on their findings. ISO 31000 was ultimately approved in 2009 by ISO, which as a worldwide federation of national standards bodies notes

that "The adoption of consistent processes within a comprehensive framework can help to ensure that risk is managed effectively, efficiently and coherently across an organization" (ISO 2009).

ISO 31000 principles can be adapted to any type of organization operating in any industry. It can be applied to cover a wide range of functions and risks within an organization. ISO 31000 begins by listing eleven principles, which are the basis of risk management and the corresponding relationships between these principles, the risk management framework and the risk management supporting processes.

As in the case of the COSO framework, the ISO 31000 risk management processes need to be tailored according to the specific needs of each organization to ensure success. Both risk management frameworks are well advanced in their development and use, so one is not expected to determine whether one is superior to the other. Risk management personnel would thereby need to consider both frameworks to gain a better knowledge base which they can utilize to formulate their own organization's risk management processes (Frigo and Anderson 2014).

The literature discussed above suggests that both ERM frameworks offer significant benefits. Although they should not be considered as a checklist, those interested in developing a risk management strategy that fits the needs of the organization shall review each framework and consider how aspects from these frameworks can be tailored and applied to address their specific needs. By using and tailoring any of the risk management frameworks, risk management personnel can benefit from a supporting body of knowledge that provides direction and a means of measuring the maturity of their ERM initiatives (ISO 2009).

2.3 Risk Management Failures

Conversely, it is appropriate to consider why and how ERM implementation can fail, as such failures can prove fundamental for other firms.

Operational risks are perhaps the most significant type of risks encountered by organizations as major losses which occurred in recent years has resulted from an unexpected failure in the company's day-to-day operations. Interest in operational risk management can be attributed to the fact that it can be fatal. An example of this is the case of BP's disaster in 2010 where an explosion on the Deepwater Horizon oil rig killed eleven workers and dumped millions of gallons of oil into the Gulf. According to the federal investigation of the Gulf spill, the disaster resulted due to a series of operational risk management failures (National Commission on the BP Deepwater Horizon 2011).

Another case is that of GM, once touted by risk professionals and academics as a risk management model for others to emulate. In 2012, while addressing the audience during RIMS enterprise risk management conference, GM executive leaders discussed their perspectives on the differences that ERM has made within their organization. On the same occasion Dr. G. Mustafa Mohatarem, the Chief Economist at General Motors, stated that

> There is a tendency to underestimate the risk… It is relatively easy to say, 'Well, it's a low probability risk, let's go on.' It may be a very low probability event, but those low probability events have a way of materializing, and we've got to understand what happens if we do it (Slezak 2014).

However, on the 16th of June 2014, it was reported by Fleming (2014) in the Los Angeles Times that due to a seemingly "low probability" event which materialised, GM had issued a recall for about 3.16 million vehicles because of problems related to their ignition switches. As a result, the company's confidence in its risk management process was being questioned. It can be argued that, in this case, their failure is attributed to the violation in most, if not all, of the components of their risk management process. This case shows that poor governance, reckless risk-taking and failure in translating risks which have been identified in the risk management process to an actionable strategy, can result in a competitive disadvantage and lead to terrible outcomes (Slezak 2014).

According to the New York Times (Norris 2014), GM knew for some time that there was a serious problem with their vehicles' ignition systems, so there is also a sense of lack of transparency in a high-risk area. This resulted in a lack of information that impeded proper decision-making as it left management with little insight about what was happening. Organizations and even entire industries need to keep learning from such events, whereas executive management and senior management need to identify common areas where risk management fails to assess the health and viability of their organization's risk management program.

2.4 Identification of ERM Best Practices

ERM is a relatively emerging management tool within the airport industry (Marsh Risk Consulting 2014). APQC conducted four research studies to help identify the best methods to design, implement, manage and cultivate ERM as an enterprise-wide management process. These studies which were carried out in 2006, 2009, 2011 and 2014 respectively, serve to provide a series of reports which build upon one another and are beneficial to those individuals who are entrusted with the implementation and managing of a robust ERM program. Three stages lead to ERM maturity:

The first stage, entitled *"Establish",* involves a reliable and repeatable process for risk identification, assessment, mitigation, monitoring and reporting to the board and top executive management, while providing training to business unit managers on common risk management language and concept (Grima and Thalassinos 2020).

The second stage, entitled *"Cultivate",* ensures that the best practices include visibility of new and emerging risks while building a risk-aware organizational culture, which can identify risks and opportunities within each business units' operations.

On the other hand, the best practices in the third stage, which is entitled *"Refine",* involve the development of a representation showing the financial impact of a par-

ticular risk, while also ensuring that strategic contingency plans include actions to address the identified risks. ERM implementation shall be backed up by an information technology infrastructure that provides uniformity, collaboration and analysis of risks (APQC 2014).

2.5 Value of Risk Management for Airports

Successful implementation of ERM allows for the identification and analysis of well-timed and accurate information about the airport's risk exposures like for example, passengers handling, airport infrastructure, tenants, terrorism and baggage handling. This knowledge can eventually be translated into value when used in the airports' management processes such as strategy development, decision making, performance management, and budgeting (ACRP 2012).

By embedding risk management and practices into the day to day decision-making and processes, it allows better visibility of an airport's risk profile. This enables airport management to identify key risks at the business unit level and to effectively manage the source that is leading to the risk and ultimately develop contingency plans based on well-informed and risk-aware decisions (Hoyt and Liebenberg 2011).

Through the process of identifying and mitigating risks, ERM enables the development of effective contingency plans to protect an airport's assets from unexpected losses and to gain competitive advantage out of the identified opportunities. Effective implementation of ERM provides a high degree of certainty towards the achievement of organizational goals and objectives as it reduces the element of unexpected outcomes. The value derived from effective implementation of ERM can be considered in two dimensions, namely, the internal value dimension and the external value dimension.

Internally, ERM contributes by serving as a tool for management to acquire a holistic view of their airport's risk profile so they can better predict their financial performance, effectively mitigate risks, leverage opportunities and make better-informed decisions. Meanwhile, ERM provides external value by serving as a tool for airports' external stakeholders' (insurance providers, auditors, public users, regulators amongst other) to gauge the effectiveness of the airport's internal risk management controls and procedures (ACRP 2012).

2.6 Implementation of ERM at Airports

Airports are an example of a risky industry and as expected, it involved a complex and a wide range of risks. On the other hand, risk management is broad and involves processes requiring multidisciplinary competences. The following section discusses ERM best practices towards successful implementation of ERM in the airport industry.

To adapt ERM to the advantage of airports, it entails leadership, dedication, and ingenuity as every airport has unique governance structure, organizational culture and operating environment which should be reflected in the airport's ERM framework. At the same time, airport business unit managers may have to combat the perception that applying ERM to their operations is too difficult, too expensive and unsustainable. Nevertheless, there are a common set of vital elements that every airport should take into consideration when adopting an ERM framework. The ACRP (Airport Cooperative Research Program) Report 74 is intended to provide guidelines for airports to implement ERM within their facility (ACRP 2012).

In this report, which is based on the guiding principles of the International Risk Management Standard ISO 31000:2009 and the COSO ERM framework, encourages airports to consider the following elements to successfully implement an enterprise-wide risk management framework:

- *Governance and infrastructure* Refer to the structure on which ERM is developed and supported across an airport. To be effective ERM needs to be centrally coordinated to have risk holistically managed, across the airport. The risk management infrastructure should be supported by an internal risk management structure that defines risk management roles, responsibilities and processes.
- *Risk identification and prioritization.* Risk identification is a very important element of a robust ERM program in which identified risks should be assessed in terms of the corresponding likelihood and financial and non-financial impact. This would enable risk prioritisation and allocation of resources for appropriate risk mitigation and control.
- *Risk treatment and control***.** This element refers to the planned measures and resources that will reduce the likelihood of a risk to materialise and the impact if the risk had to occur. An effective risk management framework seeks to control risks to an acceptable level within the tolerances of the airport's risk appetite.
- *Risk monitoring and reporting.* To ensure ERM sustainability, risk reporting and monitoring need to be supported by a strong governance framework involving all levels within the airport. This framework needs to provide a communication setup for risk information to be shared internally across the airport and externally to stakeholders, to enable proactive risk management.
- *Implementation.* An ERM implementation plan should be in place to guide the airport towards the target level of ERM maturity. All employees within the airport need to be aware of the benefits provided by ERM and should have adequate knowledge, skills and tools to contribute toward the ERM process.
- *Integration with key processes*. The ERM framework should be aligned with key processes such as budgeting, operations and strategic planning within the airport, to ensure that value is being created throughout the airport.
- *Continuous improvement and sustainability.* The ERM process shall be continuously reviewed against performance metrics and the target level of maturity. This would help risk management coordinators to identify opportunities to improve their risk management program.

The abovementioned elements shall be governed by the airport's risk management policy, which outlines the airport's commitment to risk management. The risk management policy and procedure, together with the risk management committee, comprise the airport's risk management framework (ACRP 2012).

2.7 Risk Management Policy and Procedure

The purpose of the airport risk management policy is to provide an effective structure for the management of risk across the airport and to formalise and communicate the approach towards risk management. This policy shall apply to all levels within the organization and across all business functions and department (Beasley et al. 2015).

On the other hand, the purpose of this risk management procedure is to describe the airport's standard process for the identification, analysis, treatment, monitoring and reporting of risks. This procedure supports the implementation of the airport's enterprise risk management framework, by providing a consistent approach to managing all risks and the actions necessary to reduce each risk populating an organization-wide risk register that is contributed to by all departments within the organization (Beasley et al. 2015).

2.8 Risk Strategy

Airports willing to implement a risk management framework must be aware that the risk is dynamic and inherent in all external and internal operating environments, particularly due to the existence of multiple operators at their premises. These organizations must further recognise that risk management is essential for good corporate governance and a fundamental component of good management practice.

For risk management to be effective, the organization must be committed towards the implementation of an effective risk management framework that ensures an enterprise-wide approach to managing potential risks and opportunities that may impact the achievement of organizational goals and objectives. Risk assessment and management is a critical focus for all levels within an organization including the Board of Directors, the Audit Committee, the Risk Management Committee, the Company's Management and the operating and supporting functions. Meanwhile, internal controls need to be designed to manage and mitigate risks rather than eliminate risks (COSO 2004).

2.9 Risk Appetite

In general, airports give top priority to quality and believe that quality underpins their strategic vision and objectives. Airports must acknowledge that risk is present in almost every activity and whilst the overall risk appetite can be highly cautious, the risk appetite for the individual strategic objectives can be stricter or more flexible (Marsh Risk Consulting 2014). The airport's risk appetite may vary depending on the different airports' strategic objectives.

2.10 ERM Role and Responsibilities

Risk assessment and risk management are the responsibility of the airport's management. The Risk Management Committee shall serve as a primary champion of risk management at a strategic and operational level, to ensure that a sound system is in place to identify, assess, manage and monitor risk.

- **The Board**
  - Overall responsibility for risk management
  - Determine a strategic approach to risk and set risk appetite
  - Establish a structure for risk management and ensure that risk management is embedded in all processes and activities
  - Understand the most significant risks
- **The Audit Committee**
- Monitor the effectiveness of the risk management systems and internal control
  - Assure the Board on the effectiveness of risk management structures
  - Receive reports from the Risk Management Committee and reports formally to the Board on risk management activities at least on an annual basis
- **Risk Management Committee**
  - Build a risk-aware culture within the organization including appropriate training
  - Develop and recommend to the Board a risk management framework, including the relative policy and procedures
  - Coordinate and review the risk assessment, evaluation and response processes undertaken by management
  - Monitor and report on risk performance
- **Internal Auditor**
  - Develop a risk-based internal audit programme Audit the risk processes across the organization
  - Evaluate and assure the management of risk
  - Report on the efficiency and effectiveness of internal controls

- **Business Unit Managers**
  - Build risk-aware culture within the respective units
  - Prepare/update Risk Profile (including Risk Assessment) for the respective business unit Agree risk management performance targets
  - Ensure implementation of risk treatment/mitigation measures
  - Identify and report changed circumstances/risks
- **Individual Employees**
  - Understand, accept and implement risk management processes Report inefficient, unnecessary or unworkable controls
  - Report loss events or near-miss incidents
  - Cooperate with management on incident investigations

2.11 The ERM Process

Based on international standards which are a recognised methodology of ISO 31000 and COSO ERM Framework airports, ERM framework shall be composed of the following elements or stages of the ERM process:

2.11.1 Risk Identification

This establishes the exposure of the organization to uncertainty. The failure to identify and capitalize on opportunities is also considered a risk. Business risks arise as much from the possibility that opportunities will not be realized as they do from the possibility that threats will materialize, errors are made or damage/injury may occur. Risk identification aims to produce a comprehensive list of risks and opportunities that can hinder the achievement of the airport's strategic objectives. This process shall involve information about the critical success factors and the threats and opportunities associated with the accomplishment of objectives.

This process is expected to be approached logically to ensure that all value-adding activities within the airport, have been evaluated and all the risks resulting from these activities have been defined. Risk identification shall be conducted through structured discussions at the business unit level, taking on board lessons learned and process mapping analysis. The risk identification process starts by creating a risk inventory in which current and emerging risks and opportunities are defined. This inventory shall comprise the risk profile for the respective business unit. Risks need to be classified by type, according to the risk categories listed in the following table. A particular risk may be classified under more than one risk type as shown in the following table. Moreover, by classifying risks in this manner, it allows the airport to focus on specific risk types as may be required (ACRP 2012).

2.12 Risk Analysis

This needs to be carried out on identified risks so that the management can focus its mitigation efforts on those areas, which are at a higher risk and capitalize on the largest opportunity areas

Identified risks are analyzed to form a basis for determining how they should be managed. Risks are associated with objectives that may be affected. Risks are assessed on both an inherent and a residual basis, with the assessment considering both risk likelihood and impact (COSO 2004).

Risk needs to be assessed from two perspectives—impact (severity) and likelihood (probability). Risk impact refers to the effect on the airport should the risk materialize, whereas likelihood refers to the chance of that risk materializing. The Risk Management Committee shall review the risk assessment criteria on an annual basis, to ensure that any material changes to the airport's operating conditions are incorporated.

2.12.1 Differentiation of Risks According to Underlying Causes

A particular risk can arise due to several causes and the Risk Owner will need to determine whether to differentiate the risk by a type of cause. This will depend on the likely pervasive nature of the underlying cause in terms of the way it affects the impact and likelihood of the risk. The impact and likelihood for different causes relating to the same risk can vary and in such cases, the risk needs to be analysed separately according to the underlying causes. For instance, the risk of delays in completion of works can arise due to several causes such as insufficient investigations and studies carried out before the commencement of works resulting in incorrect estimation of area/volume of works required or works disruption due to unforeseen circumstances (e.g., bad condition of utilities located under the surface, the discovery of archaeological findings, long spells of bad weather, accidents halting the works in progress due to investigations). If the impact and likelihood of the risk of delays are the same, irrespective of the cause, then this may be articulated as one risk. However, if the impact and likelihood differ, then it is advisable to articulate a separate risk statement for each underlying cause (ISO 2009).

2.12.2 Controls and Residual Risk Assessment

Airports may already have various existent controls in place for the risks that will be identified. These controls need to be identified and assessed whether they are effectively mitigating the corresponding risks to the required level. By doing so, a decision can be made about whether additional controls are required. During this process, opportunities should also be evaluated to ensure that strategies are in place to maximize value.

The controls currently in place for each of the key risks should be defined and recorded in a risk register. Using the control assessment criteria shown in the following table, each risk owner shall decide whether the current controls are fully effective and whether additional controls are required. In case partially effective controls are identified, additional controls must be put in place to adequately control the risk.

Residual risk assessment represents an assessment of the risk exposure after control measures are taken into consideration. Residual risk assessment needs to be done in the same way as the process outlined for the initial risk assessment, except that the residual risk assessment scores for impact and likelihood should be decided when current controls are taken into consideration. The risk register allows for the recording of both inherent and residual risk assessments (COSO 2004).

2.12.3 Risk Rating/Mapping

The combination of the impact and likelihood assessments allows risks and opportunities to be rated as Critical, High, Moderate or Low. This is represented in the form of a heat map which is an illustration of the airport's risk profile. The same heat map is also used as a means of communication with the board of directors, senior management and other airport stakeholders. The positioning of the residual risk on the risk map shows the risk exposure and guides the response to risk (COSO 2004).

2.12.4 Risk Evaluation and Treatment

Based on the potential impact and likelihood assessment, the risk assessment process administrators need to consider whether a particular risk is acceptable for the organization, or whether further actions are required to reduce the risk level. Once all the results are collated, the risk management committee performs a reasonableness check on the risk scores generated and discuss with the business unit managers as may be appropriate (COSO 2004).

The action to be taken for each risk depends on the overall impact/likelihood rating of the residual risk. All the residual risks that are rated as Critical or High are actioned upon. Critical risks are addressed immediately, whilst High risks are actioned in the short-term.

On the other hand, Moderate risks are monitored and justification is recorded if no response action is considered necessary. No response is required for Low risks. Deciding on the risk treatment is imperative to ensure that actions are being undertaken to mitigate key risks.

The aim of this procedure is to lower the risk exposure to a tolerable level, based on the airport's risk appetite. The actions that are going to be undertaken need to either lower the likelihood of a risk materializing, reduce the impact of the risk should it materialize, or both. This does not mean that every risk needs or can be

mitigated until it falls into the green area on the risk heat map. This is because some risks cannot be mitigated to this extent, and the airport may decide to accept at a higher level. A cost/benefits analysis about the reduced likelihood or lowered impact of the proposed actions should be taken into consideration (ACRP 2012).

There are four primary responses for those risks that require additional treatment (that is, for all the Critical and High Risks and for those Moderate Risks for which a response is warranted):

- ***Risk Avoidance:*** This can take place if a risk is undesirable because it is for example, not in line with the airport's strategy. Another example is that it may be outside of the airport's risk appetite or else the organization does not have the resources to appropriately manage the risk. Thus the decision can be to avoid the risk by for example completely stopping a certain process or activity.
- ***Risk Modification:*** This action includes improvements in the airport's strategy, procedures, systems, processes or employees as part of the measures required for additional risk control to reduce the likelihood and/or impact of a particular risk to an acceptable level.
- ***Risk Transfer:*** This involves actions like transferring the cost of the risk to a third party, such as an insurance cover.
- ***Risk Retention:*** This occurs if the airport decides to accept the risk as it is without taking any measures to mitigate it.

Risk response options are typically assessed on the extent of risk reduction that the new control action will achieve, concerning the organization's risk appetite, the extent of additional benefits or opportunities created, the cost associated with risk mitigation and the existing best practice to mitigate the risk being adopted by comparable airports (ACRP 2012).

Each risk owner is expected to develop a risk response plan in collaboration with relevant stakeholders. The response plan will be used as a tool to record the risk, assign action plan responsibilities and to monitor mitigation measures that the organization deem necessary to have in place to make sure that the risk is managed to an acceptable level. These response plans shall be submitted to the risk management committee according to the deadlines set by the same committee.

2.12.5 Risk and Response Plans Monitoring

Few risks and opportunities or action plans remain static. Risks and opportunities change, priorities change, actions are completed, and risk responses that were once effective may become irrelevant so it is important to monitor the effectiveness of the Risk Profiles and the Risk Response Plans (ACRP 2012).

The risk owners are primarily responsible to ensure that the responses included in the risk response plan remain effective and, if necessary, updated as may be required to take into account changes in circumstances. Risk owners are also responsible to ensure that the responses are implemented by the set target completion dates. The risk management committee, on the other hand, is expected to monitor

the progress and effectiveness of the risk response plans prepared by the various risk owners and the committee may discuss and follow up with the individual risk owners for this purpose.

2.12.6 Risk Profiles Monitoring

Risk profiles are updated as they are affected by changes in factors such as strategy, current projects, agendas, and stakeholders. For this reason, risk management must be a continuous process to ensure that the airport's senior management is effectively managing changes in the risk profile. Risk owners are responsible to ensure that the risk profile is updated according to changes in circumstances and the revisions to the risk profile are to be notified to the risk management committee. On the other hand, the risk management committee will coordinate a formally structured review of airport's risk register, comprising the various risk profiles of the individual business functions, at least on an annual basis (COSO 2004).

2.12.7 Key Risk Indicators

Key Risk Indicators (KRIs) are a tool used to monitor the organization's risk profile as well as the causes and drivers of the organization's key risks and opportunities. By monitoring the organization's risk profile, changes in the likelihood or impact of a risk or opportunity can be identified. KRIs is also used as assistance in the decision-making process when it comes to risk mitigation and capturing of opportunities (COSO 2004).

KRIs for an airport may include equipment downtime, aircraft and passengers movement, customers' level of satisfaction, employee turnover rates, number of incidents and so on. To enhance the risk management process, risk owners are encouraged to identify new and use current KRIs as a tool to monitor key risks and opportunities within the airport. KRIs may be assessed as part of monitoring the performance of the business unit (ACRP 2012).

2.12.8 Risk Reporting

Once the risk owner provides the risk management committee with the risk profile for the respective business function the entrusted employees need to provide the related risk response plan/s according to the timeframes set by the risk management committee. Under the direction and approval of the airport's senior management, the risk management committee may from time to time also require the risk owners to submit risk information further to the risk profiles and the associated risk response plans. The risk management committee is expected to provide updated risk reports to the senior management indicating key risks to the airport and the control and monitoring activities in place to manage those risks at least on an annual basis (COSO 2004).

2.12.9 Existing ERM Maturity Models

In 2011 AON launched a generic ERM Maturity Self-Assessment model aimed for organizations operating in various industries. Through their proposed model, ERM maturity is assessed using nine benchmarks, which they refer to as hallmarks of an advanced ERM implementation. Each hallmark is categorized into an initial, basic, defined, operational, and advanced level.

Using AON's self-assessment model, any organization can assess and compare its current ERM advancements relative to industry peers. Also in 2008, Risk and Insurance Management Society (RIMS) launched an ERM Maturity assessment model by which organizations operating in various industries can get a personalized benchmark report indicating their existing maturity level based on 25 key factors and their underlying competency drivers. This online resource is intended to serve as a roadmap for improvement of the organization's risk management program.

Moreover, Ciorciari and Blattner (2008) developed an ERM Maturity model for the banking industry, which is composed of more than 100 elements consisting of more than 600 corresponding criteria. The developed evaluation tool is intended to be used as a benchmark for organizations operating in the banking sector, to assess their ERM maturity against equivalent organizations. The maturity scale presented with this model is made up of the very week, poor, mid-good and optimized ERM maturity levels.

3 Methodology

To facilitate the achievement of the set objective we reviewed existing literature to identify a set of best practices that represent ERM maturity within organizations operating in various industries. Moreover, Advice was sought through interviews with airport risk management professionals to establish the applicability and the importance of each practice. This helped us to determine a set of best practices that represent ERM maturity in the context of an airport. These practices formulated the proposed ERM maturity index to assess the extent risk management culture and practices have been embedded within the airport's business process (i.e., answer our research questions).

This present study is based on a deductive research approach in which the first research question is addressed by reviewing existing literature to identify a set of ERM best practices that reflect ERM maturity in organizations operating in different industries. While the second and third research questions were addressed by conducting interviews on whether the identified 'best practices' are significantly applicable in the context of an airport within Europe. For this study, a structured interview schedule was identified as the most appropriate tool to ensure that questions are always answered within the same context (Public Service Commission of Canada 2009).

These consisted of nine sections (A—I) as follows. The interview questions were designed by transforming the identified best practices into 24 close-ended questions. These questions were then allocated in their respective category (B—I) to obtain the score indicating the applicability and importance of each best practice according to the consideration of the interviewed airport risk management consultants and practitioners (Money et al. 2007).

A. *General Information* Consisting of five questions meant to profile the respondents through their role and expertise concerning risk management in the airport industry.
B. *Senior Management Commitment* Consists of three questions meant to gauge the importance of having airports' senior management commitment and involvement towards the establishment of an enterprise-wide risk management process.
C. *ERM Roles and Responsibilities* Consists of four questions intended to determine the applicability and importance of having a risk management
D. *Committee* To oversee ERM roles and responsibilities across the airport.
E. *Risk Culture* This section consists of three questions meant to determine the applicability and importance of having a risk culture that influences the values, behaviours and decisions made by airport management and employees.
F. *Stakeholders Engagement* Effective ERM in various industries relies on written records and organization-wide stakeholders' engagement to ensure a high degree of information disclosure. This section consists of two questions meant to determine the applicability and importance of such practices.
G. *Communication* Complementing the previous section, this section consists of four questions, meant to gauge the applicability and importance of having all stakeholders with a clear understanding of the risks facing the airport.
H. *Decision Making Integration* This part of the interview consists of two questions, meant to assess the importance of having ERM integrated into the decision making activities across the airport.
I. *Risks Identification and Analysis* The next section consists of four questions meant to determine the importance of a continuous risk management process that consists of a department level risk assessment and documentation which is reviewed and updated at pre-determined intervals.
J. *Opportunity Recognition* The final section consists of two questions meant to gauge the importance for airports to consider ERM as a tool that provides a unique competitive advantage.

Each possible answer to these questions has a score attached to it ranging between 1 and 10, where a higher score reflects the most applicable and important best practices. The interviews were conducted between July 2019 and January 2020 administered to the target sample that consisted of 32 ERM Consultants and 28 senior or middle management practitioners in airport risk management across European airports (Specifically for airports in the UK, Italy, France, Germany, Latvia, Estonia, Chech Republic, Slovenia, Croatia, Spain, Austria, Malta, Cyprus and Greece.) using LinkedIn business-oriented social networking service as well as through personal

emails, Skype, Zoom and telephone conversations (Trochim 2006). Interviews were stopped once saturation was achieved and no further value was being obtained from extra interviews (Sauders et al. 2012).

The closed-ended questions allowed statistical analysis of scores through the use of IBM SPSS Statistics (Statistical Package for the Social Sciences). Cronbach's alpha analytical test was used to verify the reliability of data, while the one-sample t-test was conducted to determine the applicability of each 'best practice' in the business concept of a European airport. Those best practices, which resulted as not applicable, were excluded. The mean relative importance of each best practice was determined from the score given by the interviewed experts and translated to the weighting score. Since both airport risk management professionals and consultants answered the same set of questions, this allowed analysis of the different perceptions about ERM implementation in the airport industry.

4 Results and Discussions

4.1 Senior Management Commitment and Involvement (SMC)

As stated by the COSO ERM framework (2004), an organization's senior management is expected to ultimately take responsibility and assume ownership of an ERM implementation as the CEO's commitment and involvement is crucial for ERM to be successful (COSO 2004). ERM must be led and supported by senior management to gain the necessary attention and consideration to build a prevalent risk-oriented culture across the whole airport operations. Through senior management involvement and continuous communication with the organization's ERM audit or risk committee, senior management will keep an oversight of the risk facing the airport. This part of the interview consists of three questions which meant to gauge the applicability and importance of having airport senior management committed and involved in the establishment of a successful implementation of an enterprise-wide risk management approach.

We asked the respondents to score the applicability and importance according to their consideration concerning the following statements:

SMC1 At an airport there must be a formal policy statement regarding an enterprise-wide approach to risk management.

The experts mean score of 8.8 indicates that it is highly applicable for an airport to have a formal policy statement regarding an enterprise-wide approach to risk management. One of the interviewed experts noted that: "A formal policy statement regarding ERM is a formal acknowledgement of the senior management committed toward the establishment of a uniform enterprise-wide risk management approach".

ACRP (2012) suggests that an ERM policy statement should include the underlying principle of ERM, an informative section about the airport risk appetite and a clear description of the role of employees within the ERM framework.

SMC2 At an airport there must be explicit guidelines or measures for departmental managers and executives on how to assess the impact of a risk event (e.g., assigning specific monetary measures of loss or effect on revenues/profits to specific impact rankings).

A mean score of 9.6 indicates that it is imperative for an airport to have an organization-wide common definition of risk and risk assessment methodology. The interviewees noted that for a robust ERM implementation, the risk assessment process should be integrated with the corporate strategy to contribute towards the achievement of the business objectives. Senior management is expected to provide guidelines according to the corporate risk appetite regarding the risk monetary value assignment methodology based on the loss or effect on revenues or profits should the risk materialize. Since airports operations involve high-risk operations, these deserve an ERM process that can lead to a thorough understanding of underlying potential consequences. Such analysis can often uncover significant complexities that can lead to greater success when it comes to risk mitigation activities.

The third and final question concerning ERM best practices regarding senior management commitment, the interviewee sought the experts' consideration concerning the applicability of the following statement.

SMC 3 The board of directors need to be committed to ERM and supports risk management activities with defined responsibilities including managing organizational risks in line with the airport's risk appetite and accounting for risk information in the evaluation of strategic plans and objectives.

The above statement incorporates various aspects of senior management commitment and involvement in the risk management process and a mean score of eight continues to reaffirm the importance of this best practice. Crucially, the interviewed experts consider management involvement as key to help establish risk management responsibilities and to make the best use of the information generated out of the corporate risk assessment process. One of the interviewed risk management consultants observed how many organizations can collect valuable information through proper risk assessment but eventually fail to make optimal use of such information while evaluating their corporate strategic plans and objectives.

Senior management should provide guidance on how the information is to be presented and communicated to be useful for them to be integrated into their business and strategic decisions, such as mergers, business diversification plans, acquisitions, capital investments or corporate restructuring.

4.2 ERM Role and Responsibilities (ERMR)

This section of the interview consists of four questions meant to determine the experts' consideration regarding the role and responsibilities of the risk or audit committee to oversee ERM practices within airports. Having well-defined ERM roles and responsibilities is considered as one of the best ERM practices for an effective ERM implementation. The risk management committee is expected to be

headed by a member of senior management responsible to oversee and delegate roles and responsibilities to departmental managers and employees to achieve a successful ERM implementation (ACRP 2012).

Here we asked the respondents to score the applicability and importance according to their consideration with respect to the following statements regarding ERM roles and responsibilities.

ERMR1 At an airport there must be a designated individual to serve as the chief risk officer (CRO) or senior risk executive equivalent.

ERMR2 The airport's board of directors has to assign formal responsibility to one of its committees to oversee the risk management process.

A respective mean score of 7.9 and 8.3 for both the above statements highlight the importance for airports to consider whether their organization is offering adequate leadership to provide sufficient guidelines from top management to establish the corporate risk management expectations across the whole airport. According to the experts' consideration, this can be done by having a risk management committee led by an individual at senior management level who would assume overall responsibility to oversee and review the airport's risk management process and practices.

ERM 3 Risk coordinators within an airport are expected to have adequate skills, training, and resources to deliver on ERM expectations.

ERMR4 Senior executives and key business unit leaders should periodically receive formal training and guidance on risk management.

A successful ERM implementation is largely contingent upon its users, essentially, whether they can understand and have the required knowledge to perform the assigned roles and responsibilities effectively.

A respective mean score of 8 and 7.7 for both the above statements show the experts consideration with respect to the applicability of ERM training within the airport. Employees are expected to receive periodic formal training on how to make good decisions based on information generated through the risk management process to improve their day to day performance.

Moreover, training is expected to be tailored according to the employee role and responsibilities, such as senior managers should be trained on how to integrate risk management into strategic decision making while departmental employees should be trained on how to evaluate risks in terms of the occurrence probability and impact should the risk materialize. On the other hand, risk coordinators should be informed or trained about the airport's strategy regarding an enterprise-wide approach to risk management for them to be in a position to support the process and to share information about the practices and procedures across their area of responsibility.

4.3 Risk Culture (RC)

ERM integration into the organizational culture is very much considered as one of the best practices to enable a successful ERM implementation (COSO 2004). The integration of an ERM culture is one of the most difficult challenges of an ERM

implementation as it entails leading all employees to understand and presume ownership of the organization's ERM strategy, practices and processes. Employees need to be encouraged to share information with their colleagues about mistakes and things that they learnt without the fear of undesired judgement and consequences. Such a culture change can only be achieved with the support of senior management coupled with effective leadership from departmental manages and the risk management committee to positively influence the organizational culture (ACRP 2012).

The following section consists of three questions that were designed to determine the experts' consideration with respect to the best practices concerning the organization's culture, values and behaviours and their influence on risk decisions made by management and employees within an airport.

RC1 A risk-aware culture needs to be created throughout an airport to make staff at all levels have risk awareness.

Practitioners working with small airports have indicated that it is almost impossible to build a risk-aware culture across the whole airport. This is reflected by a mean score of 6.9, which is an indication that airports differ from financial and insurance organization as their operations involve a more diverse type of stakeholders. For this reason, successful integration of an ERM culture depends on stakeholders such as tenants and subcontractors offering diverse services within the airport premises.

RC2 There should not be a blame culture among the airport's management and employees.

RC3 ERM is expected to enhance a climate of trust within an airport's operations and project teams.

A successful ERM implementation is expected to generate and enhance an easy to learn environment by encouraging the sharing of information that is nourished by and sustained with a no-blame culture. This will help to instil within the company culture of learning from mistakes which would, in turn, enable the formulation of and amplify robust risk mitigation procedures (ACRP 2012).

The experts' feedback reflected by a respective mean score of 6.9 and 6.8 for both the above statements indicates that in the context of an airport, culture change should not be considered as a prime indication of ERM maturity since it involves various subcontracting companies whose culture is not easy to change, considering that their employees do not fall under the airport's direct responsibility.

4.4 Stakeholders Engagement (SHE)

Airport stakeholders including suppliers, insurance brokers, airlines, visitors, local community, auditors and travellers are highly interested in how the management of risk is being conducted by within the airport. For this reason, airports need to identify, assess and control risks, especially when strategic decisions involving high-risk operations need to be made. Stakeholders, such as local and international authorities,

demand a certain level of transparency and accountability with respect to risk management to ensure that effective risk management is being conducted within the airport.

The section below consists of two questions aimed at determining the experts' consideration with respect to a bottom-up risk management process to assess the airports' ERM Maturity.

SHE1 A bottom-up internal risk profile must be developed and communicated upward to the airport's senior management.

The experts mean score of 8.7 classifies a bottom-up approach in the development of an internal risk profile as one of the most important ERM 'best practices'. Such engagement will enable senior management to make well-informed strategic decisions through adequate information about key risks involved in every business function within the airport facility. One of the interviewed experts explained that:

> Both functions [senior management support and bottom-up information] need to operate in tandem to ensure a successful ERM implementation completely aligned with the airports day to day operations, decision-making and long-term strategic direction.

SHE2 Risk management activities are to be considered an explicit component in determining management's performance.

Organizations are considering an ERM approach as a business function that can lead to growth and performance improvements (ACRP 2012). A mean score of 6.8 indicates that even though this also applies to organizations operating in the airport industry, risk management activities should not be considered as a key component in determining the airport's management performance.

4.5 ERM Communication Process (COM)

A mature ERM framework needs to communicate information about risks internally across the airport and to external stakeholders to ensure a sustainable process and to enable a proactive risk management approach. Risk management activities such as reporting and monitoring procedures need to be periodically reviewed and assessed to enable continuous improvement by updating the process and procedures to keep providing value for the airport's operations (ACRP 2012).

Complementing the previous set of questions, this section consists of four questions that are meant to determine the applicability of ERM best practices with respect to a comprehensive communication process that enable all stakeholders, stockholders, to understand and keep updating the airport's risk profile, processes and procedures.

COM1 At an airport the board of directors is expected to periodically review and discuss in a specific meeting the top risk exposures facing the airport.

A mean score of 8.8 shows the importance of the airport's senior management's commitment to periodically review and discuss the top risk exposures facing the airport. In such meetings, senior management reviews the original risk mitigation

techniques and recalibrates if necessary. Moreover, senior management will review information about key emerging risks. By conducting periodic meetings senior management proves that ERM is being considered as an integral part in achieving the airport's business objectives.

COM2 Internal and external stakeholders are expected to receive adequate information about the airport's risks to support decisions regarding how to manage their risks.

The experts' mean score of 7.5 has supported the reviewed literature which states that the exchange of adequate information among internal and external stakeholders to support decisions regarding their risks management procedures is one of the ERM best practices. By establishing both horizontal and vertical communication channels, integration of risk management is enhanced through open consultation and communication both internally and between the airport and its stakeholders (ACRP 2012).

COM3 At the airport, all employees understand the need for or benefit of ERM.

The resulting mean score of 5.9 is influenced by the fact that, thus far, airports do not uphold the need for employees to understand ERM and its benefits as a requirement. As mentioned in a previous observation, since airport operations depend on a vast number of sub-contractors, tenants, airlines and a wide range of different companies offering their services from the airport's premises, it is not feasible to get all of these employees to understand the needs and benefits of ERM. On the other hand, such best practices would be more applicable for a bank or financial institution having a smaller number of employees in a more controllable environment.

COM4 established processes and tools to gather update and access relevant risk management information need to be available and maintained to provide needed information internally across all business units within the airport.

Accessibility for tools and information required to gather, update and access relevant risk management information is critical for and ERM implementation to be successful (COSO 2004). This is confirmed by an experts' mean score of 8.4 that indicates that the interviewed experts consider a setup that enables information to be available internally and for all business units within the airport as the requirement that a mature ERM implementation should incorporate.

4.6 Decision Making Integration (DMI)

An organization can leverage great benefits from integrating ERM into its important corporate decision-making and strategic planning activities (COSO 2004). In line with this, the following set of two questions are meant to assess the experts' consideration with respect to gauging airports ERM maturity through their current level of ERM integration with strategic decision-making.

DMI1 Business unit management across the airport formally have to consider risk information, risk tolerance and appetite, and risk mitigation strategies during decision-making activities.

A mean score of 7.9 shows that airport management is expected to continuously use ERM as a tool to help determine the feasibility of strategic decisions before committing themselves to assign the necessary resources. This best practice can be used as an indicator of ERM maturity within the airport by gauging to what extent ERM information is being used to anticipate any potential pitfalls and to exploit opportunities associated with the decisions being undertaken. Such integration of information will, in turn, provide the decision-maker with a better position when requesting senior management's approval for the resources required.

DMI2 At an airport ERM needs to be aligned and coordinated across all risk activities (e.g., safety management system, insurance purchasing decisions, customer and supplier management, human resources management and key projects implementation).

Almost all airports within Europe do have existing formal or informal strategic planning process in place that would enable them to plan their future endeavours. Since plans can be influenced by the present situation, ERM integration can be considered as a 'best practice' since it aligns the airports existing challenges with potential challenges that the airport may be facing due to the decisions taken in the strategic planning process. A mean score of 7.5 has shown that alignment of ERM across all risk activities can be considered to be relevant for the airport industry as it contributes to value creation within the airport.

4.7 Risks Identification and Analysis (RI)

Risk identification and analysis can be referred to as the process in which risks are identified, prioritized and where mitigation plans and control activities are established. A robust ERM implementation relies on good risk identification procedures as a lack of risk awareness can lead to an ineffective risk management program and inappropriate risk mitigation strategies once identified risks are assessed in terms of likelihood and potential impact and mitigated or controlled according to the assigned priority. For a robust ERM implementation, risk identification is expected to take a bottom-up approach initiated through consultation with internal experts in airport operations who know well the airports internal and external operating environments (Marsh Risk Consulting 2014).

This part of the interview consists of a set of four questions meant to gather experts' consideration regarding the applicability of gauge the airport's ERM maturity through assessment of their risk identification, analysis and evaluation techniques.

RI1 Risk identification needs to be conducted through structured discussions at the department level, taking on board lessons learned and process mapping analysis.

A mean score of 7.4 shows that in order to achieve a high level of ERM maturity airports should are expected to have a continuous process of department-level risk assessment and documentation, which is reviewed and updated at least once every year. One of the interviewed experts has remarked that "The risk identification and

analysis processes and procedures do not need to be too complicated and this process shall be subject for continuous improvement to mature over time".

RI2 Business unit leaders are expected to use both qualitative and quantitative methods and tools to access risk exposures and mitigation strategies of individual risks.

Confirmed by a mean score of 7.8, the use of both qualitative and quantitative methods and tools for accessing risk exposures can be considered as one of the 'best practices' of a mature ERM implementation within airports. Different airports use various techniques and methodologies to perform their risk identification and analysis procedures. The most common are questionnaires, surveys and interviews involving employees from across the different departments within the airport to identify most of the risks and opportunities facing the airport.

RI3 Internal and external information (from tenants, other airports, industry research, etc.) need to be used to identify the airports internal and external risks.

The importance to involve and consult both internal and external stakeholders during the risk identification and analysis processes is highlighted by a mean score of 7.9. To have a mature ERM implementation, the airport's management must be able to identify both the internal and external risks facing the airport as these might affect the achievement of the airports business objectives.

RI4 The Risk Management Committee coordinates a formally structured review of the airport's Risk Register comprising the various Risk Profiles of the individual business functions.

Even though a periodic formally structured review of the airport's risk register is a requirement for a mature ERM implementation, a mean score of 6.2 is a reflection of the experts' consideration that reviewing of risk register does not necessarily need to be done by a dedicated team of risk coordinators. Moreover, in case of small airports, a reasonably uncomplicated ERM methodology is usually adequate to be considered a mature ERM implementation, which meets the key stakeholders' expectations as naturally a correlation is expected between the airport size and its ERM approach.

4.8 Opportunity Recognition (OR)

A mature ERM implementation is expected to take into consideration both the opportunities and threats associated with a particular risk. The final section of the interview consists of two questions that are designed to have the experts' opinion regarding the applicability of assessing airports ERM maturity on whether they consider ERM as a tool that provides them with a unique competitive advantage.

OR1 The airport's risk management process needs to be considered as a proprietary strategic tool that provides a unique competitive advantage.

A mean score of 7.1 is based on the fact that once ERM within an airport is aligned with its strategic planning, ERM will become part of the airport's process and procedures to achieve its business objectives and to ultimately gain a competitive

advantage over its competitors. This would be the pinnacle of ERM maturity as it can be considered mature enough to be accepted by stakeholders as it starts providing a sense of confidence in the airport's method of operation. Also, this will affect the market share as the passenger's experience is enhanced.

OR2 The airport has to align its appetite for or tolerance of risks in the context of strategic planning.

A mean score of 8.2 highlights the importance of airports to align their risk appetite and tolerance with their long term strategic planning. Risk tolerance is usually calculated according to the financial impact the organization can withstand before its business objectives are affected (COSO 2004).

In the context of an airport, while financial measures are commonly used, there are other important factors that are usually taken into consideration such as passengers' safety, airport security, downtime, compliance with legal requirements and loss of reputation (Marsh Risk Consulting 2014).

4.9 Applicability of ERM Best Practices

Using SPSS the one-sample t-test was used to test the following hypotheses:

Null hypothesis

H_0: $\mu = \mu_0$	The ERM best practice score mean (μ) equals the hypothesized mean (μ_0) and therefore is not significantly applicable for the airport industry

Alternative hypothesis

H_1: $\mu \neq \mu_0$	The ERM best practice score mean (μ) differs from the hypothesized mean (μ_0) and therefore is significantly applicable for the airport industry

The hypothesized mean test value of three and a significance level of 0.05 was used and the results shown in Table 1 were generated. Out of the 24 ERM best practices, two had a p-value which was greater than 0.05, so by accepting the null hypothesis we could conclude that these best practices do not differ from the hypothesized mean and therefore are not significantly applicable in the context of an airport, despite being applicable for organizations operating in other industries. These two practices were COM3 (p-value = 0.006) (At the airport all employees (at all levels) need to understand the need for and benefits of ERM), and RI4 (p-value = 0.016) (The Risk Management Committee coordinates a formally structured review of the airport's Risk Register comprising the various Risk Profiles of the individual business functions) (Table 1).

Table 1 One-sample T-test

	Test value = 3					
					95% Confidence Interval of the Difference	
	t	df	Sig. (2-tailed)	Mean difference	Lower	Upper
SMC1	8.148	9	.000	5.800	4.19	7.41
SMC2	21.604	9	.000	6.600	5.91	7.29
SMC3	10.155	9	.000	5.200	4.04	6.36
ERMR1	4.496	9	.001	4.900	2.43	7.37
ERMR2	6.184	9	.000	5.300	3.36	7.24
ERMR3	8.135	9	.000	5.000	3.61	6.39
ERMR4	5.850	9	.000	4.700	2.88	6.52
RC1	5.649	9	.000	3.900	2.34	5.46
RC2	5.522	9	.000	3.900	2.30	5.50
RC3	6.219	9	.000	3.800	2.42	5.18
SHE1	15.545	9	.000	5.700	4.87	6.53
SHE2	5.339	9	.000	3.800	2.19	5.41
COM1	10.875	9	.000	5.800	4.59	7.01
COM2	7.730	9	.000	4.500	3.18	5.82
COM3	3.525	9	.006	2.900	1.04	4.76
COM4	8.734	9	.000	5.400	4.00	6.80
DMI1	9.316	9	.000	4.900	3.71	6.09
DMI2	6.548	9	.000	4.500	2.95	6.05
RI1	6.567	9	.000	4.400	2.88	5.92
RI2	9.798	9	.000	4.800	3.69	5.91
RI3	10.168	9	.000	4.900	3.81	5.99
RI4	2.954	9	.016	3.200	.75	5.65
OR1	7.795	9	.000	4.100	2.91	5.29
OR2	8.045	9	.000	5.200	3.74	6.66

Source: Authors' Compilation

Since COM3 and RI4 were deemed not significantly applicable for airports, they were removed from the list of best practices while the remaining twenty-two best practices were retained to be included in the proposed ERM Maturity Index.

4.10 Importance of ERM Criteria

Different weights were assigned to the remaining twenty-two ERM best practices. This was done by calculating the expert's mean score for each proposed ERM Maturity 'best practice' to adequately reflect the experts' consideration (Table 2).

Table 2 Best practice importance

Rank	Best practice	Maximum score	Experts mean score
1	**SMC2**—At an airport, there must be explicit guidelines or measures for departmental managers and executives on how to assess the impact of a risk event (e.g., assigning specific monetary measures of loss or effect on revenues/profits to specific impact rankings).	9.6	9.60
2	**COM1**—At an airport, the board of directors is expected to periodically review and discuss in a specific meeting the top risk exposures facing the airport.	8.8	8.80
3	**SMC1**—At an airport, there must be a formal policy statement regarding an enterprise-wide approach to risk management.	8.8	8.80
4	**SHE1**—A bottom-up internal risk profile must be developed and communicated upward to the airport's senior management.	8.7	8.70
5	**COM4**—established processes and tools to gather, update and access relevant risk management information need to be available and maintained to provide needed information internally across all business units within the airport.	8.4	8.40
6	**ERMR2**—The airport's board of directors has to assign formal responsibility to one of its committees to oversee the risk management process.	8.3	8.30
7	**OR2**—The airport has to align its appetite for or tolerance of risks in the context of strategic planning.	8.2	8.20
8	**SMC3**—The board of directors need to be committed to ERM and supports risk management activities with defined responsibilities including managing organizational risks in line with the airport's risk appetite, and accounting for risk information in the evaluation of strategic plans and objectives.	8.2	8.20
9	**ERMR3**—Risk coordinators within an airport are expected to have adequate skills, training, and resources to deliver on ERM expectations.	8.0	8.00
10	**RI3**—Internal and external information (from tenants, other airports, industry research, etc.) need to be used to identify the airports internal and external risks.	7.9	7.90
11	**DMI1**—Business unit management across the airport formally have to consider risk information, risk tolerance and appetite, and risk mitigation strategies during decision-making activities.	7.9	7.90
12	**ERMR1**—At an airport, there must be a designated individual to serve as the chief risk officer (CRO) or senior risk executive equivalent.	7.9	7.90
13	**RI2**—Business unit leaders are expected to use both qualitative and quantitative methods and tools to access risk exposures and mitigation strategies of individual risks.	7.8	7.80
14	**ERMR4**—Senior executives and key business unit leaders periodically receive formal training and guidance on risk management.	7.7	7.70

(continued)

Table 2 (continued)

Rank	Best practice	Maximum score	Experts mean score
15	**DMI2**—At an airport, ERM needs to be aligned and coordinated across all risk activities (e.g., safety management system, insurance purchasing decisions, customer and supplier management, human resources management and key projects implementation).	7.5	7.50
16	**COM2**—Internal and external stakeholders are expected to receive adequate information about the airport's risks to support decisions regarding how to manage their risks.	7.5	7.50
17	**RI1**—Risk identification needs to be conducted through structured discussions at the department level, taking on board lessons learned and process mapping analysis.	7.4	7.40
18	**OR1**—The airport's risk management process need to be considered as a proprietary strategic tool that provides a unique competitive advantage.	7.1	7.10
19	**RC2**—There shouldn't be a blame culture among the airport's management and employees.	6.9	6.90
20	**RC1**—A risk-aware culture need to be created throughout the airport to make staff at all levels have risk awareness.	6.9	6.90
21	**SHE2**—Risk management activities are to be considered an explicit component in determining management's performance.	6.8	6.80
22	**RC3**—ERM is expected to enhance a climate of trust within an airport's operations and project teams.	6.8	6.80
	Maximum Total Score	173.1	

Source: Authors' Compilation

4.11 Illustrative Example

To illustrate how the developed ERM Maturity Index may be used, we have conducted an assessment of the ERM Maturity of a medium-sized airport located in the UK (Table 3). A Corporate Risk Manager working at this airport accepted to participate by giving a score reflecting the maturity level of each of the 22 ERM best practices.

To illustrate how ERM maturity is calculated, a score of nine concerning best practice ERMR3 indicates that at this airport, risk management coordinators have almost all the necessary skills, training, and resources to deliver on ERM expectations. Since in this case, ERMR3 has a weight of eight, this number is multiplied by the score of nine which equates to 72, the score of 72 is divided by the value of perfect ERM Maturity (1731) and multiplied by 100 to achieve a result of 4.16%. This indicates that for this airport attribute ERMR3 contributes 4.16% towards perfect ERM Maturity. These calculations were carried out on the rest of the best prac-

Table 3 ERM maturity index illustrative example Authors' Compilation

ERM maturity index													
A. Senior Management Commitment										Weight	Score	% Score	
SMC1. At our airport, we have a formal policy statement regarding our enterprise-wide approach to risk management										**8.8**	**10**	**5.08**	
Strongly Disagree									**Strongly Agree**				
1	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**				
SMC2. At our airport, there is explicit guidelines or measures for departmental managers and executives on how to assess the impact of a risk event (e.g., assigning specific monetary measures of loss or effect on revenues/profits to specific impact rankings)										**9.6**	10	**5.55**	
Strongly Disagree									**Strongly Agree**				
1	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**				
SMC3. The board of directors is committed to ERM and supports risk management activities with defined responsibilities including managing organizational risks in line with the airport's risk appetite, and accounting for risk information in the evaluation of strategic plans and objectives:										**8.2**	**6**	**2.84**	
Strongly Disagree									**Strongly Agree**				
1	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**				
Category A Maturity Level:												**87.67**	
B. ERM Responsibilities													
ERMR1. At our airport there is a designated individual to serve as the chief risk officer (CRO) or senior risk executive equivalent:										**7.9**	**1**	**0.46**	
Strongly Disagree									**Strongly Agree**				
1	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**				
ERMR2. At our airport, we have a management-level risk committee (or equivalent committee consisting of (at least some of) the airport's senior executives) that formally discusses enterprise-level risk										**8.3**	**8**	**3.84**	
Strongly Disagree									**Strongly Agree**				
1	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**				
ERMR3. Risk coordinators have adequate skills, training, and resources to deliver on ERM expectations:										**8**	**9**	**4.16**	
Strongly Disagree					**Strongly Agree**								
1	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**				
ERMR4. Senior executives and key business unit leaders periodically receive formal training and guidance on risk management:										**7.7**	**3**	**1.33**	
Not at all									**Extensively**				
1	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**				

(continued)

Table 3 (continued)

Category B Maturity Level:													**53.11**
C. Risk Culture													
RC1. A risk-aware culture is created throughout the airport and makes the staff at all levels have risk awareness.											**6.9**	**3**	**1.20**
Strongly Disagree									**Strongly Agree**				
1	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**				
RC2. There is neither a blame culture nor defensive routines within the airport's management and employees.											**6.9**	**4**	**1.59**
Strongly Disagree									**Strongly Agree**				
1	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**				
RC3. A climate of trust is built up within the airport's operations and project teams											**6.8**	**4**	**1.57**
Strongly Disagree					**Strongly Agree**								
1	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**				
Category C Maturity Level:													**36.65**
D. Stakeholders Engagement													
SHE1. A bottom-up internal risk profile is developed and communicated upward to the airport's senior management:											**8.7**	**9**	**4.52**
Not at all									**Extensively**				
1	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**				
SHE2. Risk management activities an explicit component in determining management's performance											**6.8**	**3**	**1.18**
Strongly Disagree					**Strongly Agree**								
1	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**				
Category D Maturity Level:													**63.68**
E. Communication													
COM1. At our airport, the board of directors periodically review and discuss in a specific meeting the top risk exposures facing the airport:											**8.8**	**8**	**4.07**
Strongly Disagree									**Strongly Agree**				
1	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**				
COM2. Internal and external stakeholders receive adequate information about the airport's risks to support decisions regarding how to manage their risks.											**7.5**	**9**	**3.90**
Strongly Disagree									**Strongly Agree**				
1	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**				
COM3. Established processes and tools to gather, update and access relevant risk management information is available and maintained to provide needed information internally across all business units within the airport											**8.4**	**9**	**4.37**
Strongly Disagree									**Strongly Agree**				
1	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**				

(continued)

Table 3 (continued)

Category E Maturity Level:													**86.44**
F. Decision Making Integration													
DMI1—Business unit management across the airport formally considers risk information, risk tolerance and appetite, and risk mitigation strategies during decision-making activities.											**7.9**	**1**	**0.46**
Strongly Disagree									**Strongly Agree**				
1	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**				
DMI2. At our airport, ERM is aligned and coordinated across all risk activities (e.g., safety management system, insurance purchasing decisions, customer and supplier management, human resources management and key projects implementation):											**7.5**	**4**	**1.73**
Strongly Disagree									**Strongly Agree**				
1	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**				
Category F Maturity Level:													**24.61**
G. Risks Identification and Analysis													
RI1. Risk identification is conducted through structured discussions at the department level, taking on board lessons learned and process mapping analysis.											**7.4**	**9**	**3.85**
Strongly Disagree									**Strongly Agree**				
1	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**				
RI2. Business unit leaders use qualitative and quantitative methods and tools to access risk exposures and mitigation strategies of individual risks:											**7.8**	**10**	**4.51**
Strongly Disagree									**Strongly Agree**				
1	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**				
RI3. Internal and external information (from tenants, other airports, industry research, etc.) is used to identify internal and external risks:											**7.9**	**9**	**4.11**
Strongly Disagree									**Strongly Agree**				
1	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**				
Category G Maturity Level:													**93.38**
H. Opportunity Recognition													
OR1. To what extent do you believe the organization's risk management process is a proprietary strategic tool that provides a unique competitive advantage:											**7.1**	**3**	**1.23**
Not at all									**Extensively**				
1	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**				
OR2. To what extent has your airport articulated its appetite for or tolerance of risks in the context of strategic planning:											**8.2**	**3**	**1.42**
Not at all									**Extensively**				
1	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**				
Category H Maturity Level:													**30.00**
Airport ERM Maturity:											**62.96%**		

Source: Authors' Compilation

Table 4 Graphical representation of ERM Maturity. Authors' Compilation

Category	Description	Percentage Score ()%
A	Senior management commitment	87.67
B	ERM responsibilities	53.11
C	Risk culture	36.65
D	Stakeholders engagement	63.68
E	Communication	86.44
F	Decision making integration	24.61
G	Risks identification and analysis	93.38
H	Opportunity recognition	30.00
Airport ERM Maturity:		62.96

Source: Authors' Compilation

tices and the airport's level of ERM Maturity is indicated in the final percentage score of 62.96%, which can be classified as a 'Managed' level of ERM maturity.

The developed ERM Maturity index also provides management with a graphical representation shown in the following Table 4, which is meant to facilitate comparison of the eight categories of best practices so airport management can easily identify areas of improvement within their risk management program.

5 Conclusions

A strong value proposition exists for those airports who strive to adopt an enterprise-wide approach to manage their risks. A mature ERM implementation involves a continuous process in which risk identification and evaluation provide timely and accurate information about the airport's current risk exposures. Since ERM development is a continuous process, at each stage of maturity, risk managers need to keep finding new ways to improve the effectiveness of their ERM implementation. The developed ERM Maturity Index offers airport risk managers a tool by which they can periodically gauge their progress and help identify the best route to sustain continuous improvement. Furthermore, the model, in line with the proposals set out is COSO (2017), caters for asessing the integration of strategy, governance, culture, performance and value-adding in accordance with the appetite, practicality and tolerance when addressing risk.

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Relation Between Pro-ecological Attitudes and Behavior: Comparison Between Poland and Belgium

Dominika Adamczyk, Daria Affeltowicz, and Dominika Maison

Abstract Ecology has been a growing trend in Europe for the last 20 years. As a consequence, companies are pressured to produce more environmentally-friendly products. The main aim of our study was to explore how consumers answer to the pro-ecological trends, and what are their pro-ecological attitudes and behaviors. The pro-ecological attitudes and behaviors of consumers from two countries were explored: Poland—with a shorter tradition of ecological trends (former Eastern Bloc), and Belgium—with a longer tradition (Western country). To verify if there are differences in approach towards ecology between two countries, online surveys were conducted (in Poland and in Belgium) based on representative nationwide samples: people aged 18+ (quotas on gender, age and region), responsible for household shopping (Belgium: n = 823; Poland: n = 1075). Polish and Belgian consumers differ in respect of pro-ecological attitudes and behaviors. On the level of declarations, Polish consumers claim to be more concerned about ecology, and also declare more ecologically responsible behavior. Moreover, pro-ecological attitudes are more prevalent among women than men as well as among people with a higher education, however, this effect can only be seen among Polish customers. The study has both scientific and managerial implications. It contributes to general discussion regarding relationship between attitudes and behaviors and can be useful for building product strategies, communication and decision-making managers concerned with the environmental responsibility in brand positioning.

Keywords Ecological attitudes and behavior · Ecological decision making · Consumer choices

D. Adamczyk (✉) · D. Affeltowicz · D. Maison
Faculty of Psychology, University of Warsaw, Warsaw, Poland
e-mail: dominika.adamczyk@psych.uw.edu.pl; daria.affeltowicz@psych.uw.edu.pl; dominika@psych.uw.edu.pl

K. Nermend et al. (eds.), *Decision-Making in Management*, Contributions to Management Science, https://doi.org/10.1007/978-3-030-67020-7_19

1 Introduction

Over the past 20 years there has been growing interest among Europe's inhabitants in environmental protection and ecology. Ecology and fostering the environment are very much in line with the corporate social responsibility strategy. Companies increasingly often incorporate fostering the natural environment into their CSR strategy and references to ecology are ever more present in marketing strategies, which are taken into account in product positioning and marketing communication. However, it is at this point that the question arises as to how these types of communication actions carried out by firms translate into consumer attitudes and behavior? To what extent are consumers genuinely interested in products that are manufactured in an environmentally friendly way? How willing are consumers to pay more for products where the good of the environment is at stake?

The answer to these questions concerning consumer reactions to the pro-ecological communication of companies may help in making managerial decisions concerning product positioning and communication. To what extent is it worth referring to caring for the natural environment in brand communication, and are such references worthwhile from the consumer's perspective? It is likely that consumers react in different ways to the pro-ecological actions of firms. Their reactions may depend on many demographic, psychological, and cultural traits. A study comparing the approach of Poles and Belgians to ecology, namely, their attitudes and behaviors to environmental protection, will be discussed in detail in this chapter. In the first part of the chapter, the literature review concerning consumers' approach towards ecology is presented. After that, sample, tools and analysis results are discussed. Since the studies were carried out on representative samples in both countries it is possible to compare the results between Poland and Belgium.

2 Literature Review

Growing consumer concerns associated with climate change have spurred a demand for environmentally-friendly products and services, which in turn have contributed to the emergence of a new marketing approach commonly referred to as *green marketing* and, thereby, a new consumer called the *green consumer* (Azila et al. 2012; D'Souza et al. 2007; Katrandjiev 2016; Polonsky 1994). This growing consumer interest is accompanied by an increasing number of studies on ecological/green consumption (e.g., Fraj-Andrés and Martínez-Salinas 2007; Jansson et al. 2009; Laroche et al. 2001; Peattie 2010). Although consumer behavior researchers and marketing experts started to take interest in ecology-related topics as early as in the 1970s, the greatest spike in interest in the impact of human activity on the environment can be observed towards the end of the 1990s (Peattie 1995).

An important question in the context of ecological attitudes and behaviors is what underpins whether somebody is more eco-oriented or less, and which traits are

conducive to pro-ecological behaviors and which are not. The profile of a person who is willing to pay more for eco-friendly products can be created based on five categories: demographic variables, knowledge, values, attitudes, and behaviors (Laroche et al. 2001).

Many studies have focused on the demographic traits that correlate with pro-ecological behaviors. According to Kollmuss and Agyeman (2002), it is precisely variables like age, sex, level of education, and income that are most predictive of behaviors associated with environmental improvement. It is usually women and with a higher education that are taking pro-ecological actions (Azila et al. 2012; Kaufmann et al. 2012; Straughan and Roberts 1999). Furthermore, persons of higher income are more inclined to embrace pro-ecological behaviors, however, this relationships seems to result from their higher level of education, which is more common among higher earners, and translates into a greater awareness of social responsibility issues (Kinnear et al. 1974). In so far as the results of research concerning sex and education seem to be consistent, the relationship between age and undertaken pro-ecological behaviors appear to be not entirely unequivocal. On the one hand, literature reveals that younger persons are more ready to take ecology-related actions than older persons (e.g. Barksdale and Darden 1972). This is explained by the fact that younger people grew up in a time of a growing importance of environmental issues, which naturally made them more sensitive to these topics (Straughan and Roberts 1999). However, other research shows that pro-ecological behaviors are more common among older people (Roberts 1996). Azila et al. (2012) point out the ambiguity of results concerning age and ecological behaviors. They also refer to the fact that reports on the dependency between age and a pro-ecological attitude appear mainly among the early studies on the topic, namely, from the 1970s, 1980s, and 1990s, when the age-dependent approach to ecology was more differentiated—at the time, older people were brought up in a world where the topic of ecology was simply non-existent. Presently, these differences in approach to environmental protection among people of different ages do not have to be very visible.

Numerous research on ecology shows that it is not just the demographic traits that are of essence but also certain other personality traits that are conducive to pro-ecological behaviors, among others including integrity, openness or altruism (e.g. Brick and Lewis 2014; Kaufmann et al. 2012; Markowitz et al. 2012; Pavalache-Ilie and Cazan 2018).

Independent of the research revealing the dependencies of pro-ecological behaviors on demographic and personality traits, it turns out that pro-ecological attitudes (Bui 2005; Han et al. 2009; Han et al. 2011; Laroche et al. 1996; Ueasangkomsate and Santiteerakul 2016; Vazifehdoust et al. 2013) and knowledge about ecology (Fraj-Andrés and Martínez-Salinas 2007; Mohd Suki 2013) are also strong predictors of such behaviors. As an example, the level of concern for environmental issues of a given person, thus, their attitude towards the environment, was acknowledged as a predictor of such ecological behaviors as recycling (Simmons and Widman 1990), environmental protection-related purchase decisions (Chan 1996), or buying organic food (Nasir and Karakaya 2014). The mentioned research findings are consistent with the assumptions made in the 1970s, namely, that educating society

about ecology should give rise to a change in pro-ecological attitudes and, consequently, impact their behaviors. Nowadays, such direct relationships between knowledge, attitudes, and behaviors are called into question (Kollmuss and Agyeman 2002). Raising awareness on environmental change and ecological education in many cases does not lead to pro-ecological behaviors. Many studies show that persons with pro-ecological attitudes do not always translate their worldview into behavior or consumer decisions (e.g., Carrington et al. 2010, 2014). In other words, persons declaring to care for the environment do not always behave in a way that positively impacts the environment. This inconsistency between attitudes and behavior (also observed in other areas of behavior) is explained in many different ways (Carrington et al. 2010; Kaufmann et al. 2012; Kumar and Ghodeswar 2015; Michaelidou and Hassan 2008). One such explanation points out the fact that actual behavior does not just result from attitudes but also from many situational factors, that is, the impact of an external situation on the behavior of a given person (Gaspar et al. 2010). The situation a person finds themselves in, their environment and their social and cultural determinants affect their final decisions and undertaken pro-ecological behaviors. A similar explanation for the discrepancy between attitudes and behaviors was offered by Rajecki (1982), who stated that social norms, traditions and culture are just some of the factors underpinning it, that is, if the dominant behaviors in a given culture are inconsistent with the spirit of ecology, it is highly probable that the behavior of the individual will also not be ecological.

Studies to date show that knowledge about issues relating to environmental protection, attitudes towards the environment, and pro-ecological behaviors differ depending on the culture (do Paço et al. 2013; Laroche et al. 1996; Laroche et al. 2009). Researchers draw attention to the fact that inhabitants of different countries understand the value of ecology differently. For instance, the studies of Aoyagi-Usui et al. (2003) show that the inhabitants of Asia combine ecological values with traditional values like family and looking after close relatives and friends, whereas people from the West (USA) link them with altruistic, not traditional values.

Laroche and colleagues in their research (Laroche et al. 1996; Laroche et al. 2009) underline that the differences in the approach to ecology do not just occur on a country level but also on the level of culture. Comparing French and English Canadians, they came to the conclusion that the differences in the approach to ecology of these two groups result from disparities in access to information and social class belonging. Studies on the differences between cultures, also in this case, often refer to the terms collectivism and individualism (Cho et al. 2013). Some researchers even go as far as to posit that *green consumerism* is not a social construct that, by its very nature, significantly differs depending on the cultural context (Autio et al. 2009). Cultural differences can also affect the way in which consumers react to behaviors, actions, and products intended to improve the environment (Oliver and Lee 2010).

Studies show that there are also differences in approach to ecology between the inhabitants of European countries. do Paço et al. (2013) carried out a comparison between young inhabitants of Germany, Portugal, Spain, and Great Britain, checking whether they differ in terms of pro-ecological attitudes and behaviors. They

pointed out that in so far as on the level of declared interest in ecology issues the citizens of Western Europe are on a similar level, there are differences when it comes to behaviors, which are probably associated with the level of development of the country. The inhabitants of Great Britain and Germany turned out to be the most eco-friendly, while the least were the residents of Portugal and Spain. The authors compared countries with a similar level of ecological awareness, however, it would also be worthwhile focusing on the citizens of countries where the tradition for ecological behaviors does not go back that far.

Considering the varied approaches and levels of interest in ecology issues across European countries, it would also be interesting to check if there are any significant differences between countries in terms of pro-ecological attitudes and behaviors. The aim of this chapter is to jest find out how citizens from Western Europe with a higher ecological awareness or longer history of state environmental stewardship approach this topic compared to the inhabitants of Eastern European countries where ecology is a relatively new topic in the general awareness of their citizens. To do this, a study was conducted comparing the inhabitants of Poland and Belgium in order to verify whether there are any significant differences between the approaches of the citizens of these two countries to environmental issues and between the behaviors undertaken by them. Although there have been no previous studies comparing Polish and Belgian consumers, there are certain premises that allow us to believe that the inhabitants of these two countries differ in their approach to ecology and pro-ecological behaviors. A 2017 European Commission Report (Eurobarometer 2017) points out that Poland has one of the lowest indicators among the European Union countries for treating environmental issues as important. Other studies carried out in 2018 (Poortinga et al.) confirm the previous reports, placing Poland at the end of the list of countries whose citizens are concerned about the effects of climate change. This finding is similar to those observed in other Eastern European countries. Although eco-friendly product segments like food, for instance, are growing at a fast pace in Poland, this product category still has a small market share compared to Western markets (Willer and Lernoud 2019).

The aim of the analysis of the results presented in this chapter is to compare Poles and Belgians in terms of their pro-ecological attitudes and behaviors. The following assumptions have been made:

H1. Poles, because of their shorter experience of a country that fosters ecology and pro-ecological behaviors, will have less positive attitudes towards ecology than the Belgians.

H2. Similarly, in the case of pro-ecological behaviors, which will be more prevalent in Belgians than in Poles.

We also wanted to ascertain whether demographic variables will be related to the approach to ecology. In this part of the research, due to its exploratory nature, it was not hypotheses but research questions that were posed: Do women and men differ from each other in terms of pro-ecological attitudes and behaviors? Will people of different ages and people with different education levels have different approaches to ecology on the level of behavior and attitudes?

3 Methodology

3.1 Sample

The study was conducted with the use of a Computer Assisted Web Interview (CAWI) on an online panel. Adult Poles and Belgians (aged 18+) took part in the study. The study was conducted in 2019, in April (Belgium) and October (Poland). In both countries, a representative sample was used in the study, which reflected the structure of the inhabitants of a given country in terms of sex, age, and place of residence. The sample size was n = 823 in Belgium, and n = 1075 in Poland. In the Polish part of the study, a total of 560 women and 515 men aged 18–85 years (M = 45, SD = 15.4) took part, whereas in the Belgian portion, 411 women and 412 men aged 18–68 years (M = 43.5, SD = 14.67) participated. The study was part of a larger project executed under the EIT Food "GLAD—Green Last Mile Delivery: a more sustainable way for home delivery tailored to personalized nutritional needs" grant (number 19147). Only a selection of the results has been presented in this chapter. All the participants gave their consent to taking part in the study after having familiarized themselves with detailed information on the aim and procedure of the study.

3.2 Tools

Due to the overarching objectives of the research project, most scales used in the study were designed specifically for its requirements.

3.2.1 Pro-ecological Attitudes

The scale of pro-ecological attitudes comprises six statements with the possibility of responding on a 5-point scale (1-definitely disagree, 5-definitely agree). The presented statements concerned two areas:

(a) Faith in the sense of pro-ecological actions, a skeptical approach to ecological actions (e.g., "I think it's pointless for me to take actions to protect the environment since most people don't do this")—3 questions
(b) Ecological responsibility (e.g., "The government (people who run the country) should first and foremost care for the environment")—3 questions

In line with the aim of the study, the questions were recoded so that the higher value means a higher pro-ecological attitude level. The pro-ecological attitudes scale was created by summing the responses to the questions and its indicator was a result ranging from 6 to 30 points. The higher the result on the scale, the higher the

pro-ecological attitude level (stronger belief in the sense of ecological actions, greater ecological responsibility).

The reliability of the scale measured using Cronbach's alpha was 0.64. The Cronbach's alpha method for measuring reliability is characterized by sensitivity to the number of items in a scale, thus, it can be assumed that the level of reliability obtained for a scale comprising 6 questions is satisfactory.

Sub-scales were also created by summing some of the questions, they included two areas: (a) Belief in the sense of ecological actions (Cronbach's alpha = 0.75), and (b) ecological responsibility (Cronbach's alpha = 0.69).

3.2.2 Willingness to Incur Costs

The next scale concerned the declaration of willingness to incur higher costs to protect the environment. The respondents answered to three questions referring to different aspects of life:

(a) "Would you be willing to pay higher prices for products in stores in order to protect the natural environment?",
(b) "Would you be willing to pay higher taxes if some of them were for protecting the natural environment?",
(c) "Would you be willing to reduce your own standard of living (e.g., a longer or less comfortable journey to work, a smaller/more eco-friendly flat or house, etc.) to protect the natural environment?").

There was a 4-point response scale to each of the questions for the respondents: 1—definitely not, 2—probably not, 3—probably yes, 4—definitely yes.

The willingness to incur costs scale was created by summing the responses to the questions and its indicator was a result ranging from 4 to 12 points. The higher the result on the scale, the greater the willingness to incur costs to protect the environment. The reliability of the scale measured using Cronbach's alpha was 0.81, which allows the scale to be considered reliable.

3.2.3 Pro-ecological Behaviors

The next measurement concerned the pro-ecological behaviors undertaken. The respondents were asked to specify how often each of the 14 behaviors from the list is undertaken by them. The following responses were possible in relation to each behavior: 1—never, 2—sometimes, 3—often, 4—always (e.g., "I buy drinks in recyclable packaging (glass, returnable plastic)", "I have opted out of receiving paper bank statements, bills, and invoices out of concern for the environment", "I save water (e.g., when brushing my teeth or taking a bath or a shower)". The result on the scale could range from 14 to 56.

The reliability of the scale measured using Cronbach's alpha was 0.87, which allows the scale to be considered reliable.

4 Results

4.1 Comparison of Pro-ecological Attitudes of Poles and Belgians

In the first step of the analyses, the decision was made to check what the pro-ecological attitudes of Poles and Belgians are like and whether the representatives of these two countries differ from each other in terms of their approach to ecology, understood as a belief in the sense of ecological actions and ecological responsibility (Table 1). To this end, the differences in the summed responses to the questions on the ecological attitudes scale was investigated (minimum = 6, maximum = 30). The differences in pro-ecological attitudes of Poles and Belgians were statistically significant. Poles declared a more positive attitude to environmental issues than Belgians, both on the general scale (PL = 18.85; BE = 16.40), as well as within the sub-scales: stronger belief in the sense of pro-ecological behaviors (PL = 10.82; BE = 9.56), and declared assuming a greater ecological responsibility (PL = 8.03; BE = 6.83).

The conducted analyses show that Poles and Belgians differ in terms of their pro-ecological attitudes. Polish citizens declare a stronger belief in the sense of undertaking pro-ecological actions and perceive a greater necessity than Belgians for such actions to be taken by a person without shirking the responsibility to external institutions.

4.2 Comparison of Declaration of Willingness to Incur Higher Costs on Environmental Protection Among Poles and Belgians

The next step involved checking if, apart from the approach to ecology, the respondents from these two countries declare their willingness to incur higher costs (taxes, product prices) to protect the natural environment. The t-test revealed statistically significant differences between both countries, $t(1896) = -4.45$; $p < 0.001$. Poles

Table 1 Differences between pro-ecological attitudes and behaviors among Poles and Belgians

	Mean		Statistics		
Variable	Poland	Belgium	df	t	p
Pro-ecological attitude (general indicator)	18.85 (SD = 3.82)	16.40 (SD = 3.59)	1895	−14.22	<0.001
Belief in the sense of pro-ecological behaviors (sub-scale)	10.82 (SD = 2.78)	9.56 (SD = 2.92)	1895	−9.56	<0.001
Ecological responsibility (sub-scale)	8.03 (SD = 2.08)	6.83 (SD = 2.03)	1895	−12.51	<0.001

Table 2 Differences between declared willingness to incur higher costs to protect the environment among Poles and Belgians

Variable	Mean		Statistics		
	Poland	Belgium	df	t	p
Declared willingness to incur higher costs (general indicator)	**7.03** (SD = 1.90)	6.59 (SD = 2.24)	1896	−4.45	<0.001
Declared willingness to reduce their quality of life	2.41 (SD = 0.77)	2.31 (SD = 0.88)	1896	−2.87	0.004
Declared willingness to pay higher taxes	2.25 (SD = 0.81)	2.05 (SD = 0.87)	1896	−4.96	<0.001
Declared willingness to accept higher prices in stores	2.37 (SD = 0.78)	2.24 (SD = 0.87)	1896	−3.51	<0.001

declare a greater willingness to reduce their standard of living, pay higher taxes, and accept higher product prices in stores if this would have a positive effect on the natural environment (M = 7.03) than Belgians (M = 6.59) (Table 2). Moreover, Poles also declare a greater willingness than Belgians to reduce their quality of life and accept higher product prices if this was to benefit the environment.

4.3 Pro-ecological Behaviors Among Poles and Belgians

The next analysis checked the differences in intensity of pro-ecological behaviors between Poles and Belgians. A comparison of the aggregate behavior indicator (minimum = 13, maximum = 52) revealed statistically significant differences between Poland and Belgium, $t(1899) = -6.87$; $p < 0.001$. Poles declared more pro-ecological behaviors than Belgians (BE = 34.00; PL = 36.00). Poles more often than Belgians claimed avoid buying products in plastic containers, use more energy efficient household appliances and lighting, buy organic and local produce, and save water (Table 3).

The above analyses show that Poles are much more environmentally involved than Belgians in terms of attitudes, and when it comes to declared behaviors, the everyday habits of Poles seem to be more eco-oriented than the behaviors of Belgians.

4.4 Demographic Variables Vs. Pro-ecological Attitudes and Behaviors

The last step of the analyses involved investigating the extent to which demographic traits differentiate the pro-ecological attitudes and behaviors of Poles and Belgians.

Table 3 Differences between pro-ecological behaviors among Poles and Belgians

Variable	Mean		Statistics		
	Poland	Belgium	df	t	p
Pro-ecological behaviors (general indicator)	**36.00** (SD = 6.27)	34.00 (SD = 6.77)	1896	−6.871	<0.001
Use detergents and cleaning products economically	**2.77** (SD = 0.77)	2.54 (SD = 0.86)	1896	−6.24	<0.001
Choose to buy more natural cleaning products	2.40 (SD = 0.83)	**2.45** (SD = 0.89)	1896	1.14	0.003
Pay attention to environmentally friendly packaging	2.54 (SD = 0.76)	**2.60** (SD = 0.83)	1896	1.46	0.002
Buy drinks in recyclable containers (glass, returnable plastic)	**2.51** (SD = 0.73)	2.48 (SD = 0.87)	1896	−0.94	<0.001
Avoid buying products in plastic packaging	2.37 (SD = 0.74)	2.33 (SD = 0.79)	1896	−0.92	0.31
Crush cartons and packaging before throwing them away	**3.36** (SD = 0.75)	3.23 (SD = 0.92)	1896	−3.47	<0.001
Choose public transport or cycling over a car	2.49 (SD = 0.93)	2.33 (SD = 0.99)	1896	−3.48	0.06
Use energy-saving household appliances at home	**3.02** (SD = 0.78)	2.83 (SD = 0.87)	1896	−5.04	<0.001
Use energy-saving lighting at home	**3.30** (SD = 0.79)	2.95 (SD = 0.93)	1896	−8.70	0.01
Buy certified organic products	2.34 (SD = 0.67)	2.21 (SD = 0.77)	1896	−3.79	0.15
Opted out of receiving paper bank statements, bills, and invoices out of concern for the environment	**3.05** (SD = 0.88)	2.67 (SD = 0.95)	1896	−8.88	<0.001
Save water (e.g., when brushing teeth and taking a bath or shower)	**3.11** (SD = 0.78)	2.90 (SD = 0.89)	1894	−5.40	<0.001
Choose products manufactured locally (in Poland/Belgium)	**2.75** (SD = 0.65)	2.41 (SD = 0.72)	1894	−10.54	<0.001

4.4.1 Sex and Country Vs. Attitudes and Pro-ecological Behavior

In order to verify if a relationship exists between sex, the nationality, and their approach to ecology (attitudes, willingness to incur costs, and behaviors), a two-way analysis of variance was carried out (ANOVA) with a 2 × 2 design (sex: woman, man; country: Poland, Belgium). When it came to the willingness to incur costs and pro-ecological behaviors, no interaction effect between sex and country, only a main effect of the country was observed. Poles declared a greater willingness to incur additional costs if this would involve improving the environment, and undertook behaviors intended to improve the environment more often than Belgians. These results were described in the previous part of the analyses.

Table 4 The results of two-way analysis of variance (ANOVA 2 × 2): differences in pro-ecological attitudes, willingness to incur costs, and pro-ecological behaviors depending on sex, age, and place of residence

Variable	Effect	Statistics			
		df	F	p	η^2
Sex					
Pro-ecological attitude	Main effect: Country	1	200.73	**<0.001**	0.10
	Main effect: Sex	1	9.40	**<0.001**	0.01
	Interaction effect: Country × sex	1	11.80	**<0.001**	0.01
Willingness to incur costs	Main effect: Country	1	19.81	**<0.001**	0.01
	Main effect: Sex	1	0.36	0.55	0.00
	Interaction effect: Country × sex	1	0.31	0.58	0.00
Pro-ecological behavior	Main effect: Country	1	46.30	**<0.001**	0.01
	Main effect: Sex	1	10.92	**0.001**	0.01
	Interaction effect: Country × sex	1	0.31	0.58	0.00
Education					
Pro-ecological attitude	Main effect: Country	1	176.11	**<0.001**	0.09
	Main effect: Education	1	7.00	**<0.001**	0.01
	Interaction effect: Country × education	1	4.66	**0.03**	0.01
Willingness to incur costs	Main effect: Country	1	7.09	**0.01**	0.01
	Main effect: Education	1	9.80	**<0.001**	0.01
	Interaction effect: Country × education	3	8.93	**<0.001**	0.01
Pro-ecological behavior	Main effect: Education	1	9.74	**<0.001**	0.03
	Main effect: Country	1	24.51	**<0.001**	0.01
	Interaction effect: Country × education	3	2.99	**0.03**	0.01

However, in the case of pro-ecological attitudes, a statistically significant interaction effect was observed between sex and the country of origin of the study group, $F(1.1893) = 11.80$; $p = 0.001$, $\eta 2 = 0.006$ (Table 4). The pro-ecological attitudes were similar in women and men in Belgium (M = 16.37 for women, and M = 16.43 for men). In Poland, there were differences: women demonstrated a more positive pro-ecological attitude than men (Women = 19.39, Men = 18.27), $p < 0.001$.

The conducted analyses revealed statistically significant differences between women and men in their approach to ecology. It turns out, however, that they mainly occur in Poles: women are more ecology-oriented but only on the level of attitudes, not behaviors. Whereas the Belgians, regardless of sex, have a similar approach to ecology.

4.4.2 Education and Country Vs. Attitudes and Pro-ecological Behavior

Another step in the analyses was to verify the relationship between education, country, and attitudes as well as pro-ecological behaviors.

Next, two-way analysis of variance (ANOVA) with a 2×2 design (education: lower, higher; country: Poland, Belgium) and the relationship of these two variables between willingness to incur costs and pro-ecological behaviors was analyzed.

In the case of pro-ecological attitudes, the analyses revealed statistically significant differences between persons with different levels of education in Poland and Belgium, $F(1.1893) = 2.99$; $p = 0.03$, $\eta 2 = 0.01$ (Table 4). In the case of Belgians, education does not play a statistically significant role in relation to pro-ecological attitudes, $p = 0.76$. Among the respondents from Poland, one could observe a statistically significant difference at the $p < 0.001$ level between persons with lower education ($M = 18.44$) and higher education ($M = 19.36$). Persons with a higher education than secondary were characterized by more positive pro-ecological attitudes than persons with a lower level of education.

Similar results were obtained while analyzing the relationship between education, country, and declared willingness to incur higher costs if this would involve fostering the environment. Two-way analysis of variance, $F(1.1894) = 8.94$, $p < 0.001$, $\eta 2 = 0.01$, revealed a significant interaction effect between education and the nationality of the study group. Also in this case, the demographic variable only differentiated Poles, where Polish citizens with lower education declared that they are less willing to incur additional costs if they involved fostering the environment, ($M = 18.44$) than citizens with higher education ($M = 19.34$), $p < 0.001$. As for Belgians, the difference between persons with a higher and lower education was not statistically significant.

In the case of pro-ecological behaviors, the analyses failed to show an interaction effect between education and country, however, they did point to a country main effect, which was described in the previous analyses.

The situation was similar when it came to sex. Here, the differences in relation to ecology and education occur only on the level of attitudes and declarations, and not on the behavior level. These differences concern citizens of Poland; Belgians, regardless of their level of education, demonstrate the same level of attitudes towards ecology.

5 Conclusions

The conducted analyses revealed significant differences in the approach to ecology of Poles and Belgians. On the level of attitudes and declared willingness to incur additional costs to protect the environment, Poles seem to be more pro-ecological than Belgians. What is more, the analysis of behaviors showed that Poles in many areas behave more pro-ecologically on a day-to-day basis.

Contrary to the assumptions resulting from the longer tradition of interest in ecological issues in Western European countries, our research has shown that Poles declare a greater than Belgians willingness to incur costs to protect the environment. This result is very puzzling because it is not consistent with both the existing data and observations of Polish consumers' financial decisions (Maison 2019). One of

the explanations of this observation might be the fact that ecology has relatively recently become a hot topic in Poland, which may lead to people being more sensitive to ecology issues. It may also be connected with the fact that there are higher social expectations of pro-ecological behaviors, which are still new in Poland, and they may also be perceived as modern behaviors. Thus, it can be reasonably expected that the declarations of Poles may, to a large extent, result from self-presentation bias and are more declarations that do not always have to translate into actual behaviors (in this case paying more in purchase situation).

Another observation concerns pro-ecological behavior of Poles and Belgians. These data also show a rather surprising picture of the results. First of all, Poles declare to undertake more pro-ecological behavior than Belgians pay greater attention to the environmentally friendly packaging and more often choose natural cleaning products. This result may be due to the specificity of the market offer, where the availability of ecological cleaners in Poland is still very limited. Also, the fact that the research in Poland was conducted after implementing the new law (obligatory payment for plastic bags) may influence the results. Poles wanting to avoid additional fees when shopping, could pay more attention to having their own, non-plastic bag. Polish consumers, on the other hand, declare to buy energy saving household appliances at home, use detergents and cleaning products economically or buy drinks in recyclable containers may be driven by economic motivation more than real care about environment. Other behaviour indicated by Polish consumers more often than Belgian ones was choosing products manufactured locally. This behavior might be also more driven by healthy reasons (in Poland local food products are perceived as healthier or a way to support local famers) than real care about the environment.

The described findings revealing the differences between pro-ecological attitudes and behaviors in Poland and Belgium also have another meaning and it is worthwhile taking this up in the general discussion on the relationship between attitudes and behaviors. In the initial phase of the study on attitudes, there was a prevailing belief that three attitude components: beliefs, emotions, and behaviors are not interrelated, while behaviors directly result from attitudes (Aronson et al. 2014). However, with time, more and more research in different areas has supplied information that this is not always the case. A meta-analysis of 88 attitude-behavior researches carried out by Kraus (1995) delivered evidence of a low degree of relation between the three components of attitude. The average correlation between attitude and behavior was on the level of $r = 0.38$. Whether or not this relation will be very strong or almost non-existent in a particular case depends on a variety of different factors, on the type of attitude, and the kind of measures applied. This discrepancy can not only result from the fact that a person may not want to reveal their true attitude (e.g., due to self-presentation bias), but also from a person not always being fully aware of their attitude, as many attitudes are unconscious (Murphy and Zajonc 1993; Zajonc 1980), implicit (Greenwald and Banaji 1995), dual (Chaiken and Trope 1999), and have an automatic character (Bargh and Chartrand 1999).

The results concerning the differences between the approach of women and men to ecology confirm the findings of previous research where women were usually found to be more ecologically conscious and make ecologically-motivated consumer decisions significantly more often than men (Banerjee and McKeage 1994). Just like in the case of sex, behavior researchers interested in ecology issues refer to the level of education as a variable associated with pro-ecological attitudes and behaviors. The studies conducted by us point to a dependency between sex and education only in the group of Poles; the Belgians behave equally ecologically independent of their sex and level of education. This difference between Poland and Belgium may result from the fact that talking about ecology and promoting pro-ecological behaviors has a longer tradition in Belgium, thus, is more prevalent among all consumer groups. In the case of Poland, however, more sensitive groups, or emotionally (women), and intellectually (better educated) are first and foremost more reactive to pro-ecological messages.

In so far as most demographic variables (sex, education, and income) were extensively studied and described by authors dealing with consumer behaviors already in the 1990s, the issue of age remains unresolved. Indeed, there are studies suggesting there is no correlation between age and pro-environmental behaviors, while some describe statistically significant negative correlations, and others still significant positive correlations between age and ecological behaviors. The research findings that we have presented have not shown any significant differences in this respect.

The study conducted by us has many managerial implications. Firstly, the people running the company, creating the product strategies and their communication increasingly refer to their ecological qualities. In this situation, gaining an understanding of the attitudes and behaviors of consumers is very much desired in order to foresee whether references to ecology of fostering the natural environment in product communication will indeed bring the desired results—enhancing product perception, increased product interest and, ultimately, making a purchase. Another important point is that decision-making managers concerned with the environmental responsibility in brand positioning should be cognizant of the fact that consumers may overstate their willingness to undertake pro-ecological behaviors in studies. Here, an excellent example of this are the responses of Polish consumers to the question of their willingness to incur financial costs to protect the environment (taxes and product prices). Such pro-ecological declarations most probably still marginally translate into behaviors, as can be seen from the relatively small share of ecological products in the Polish market to date.

One limitation of this research may be that the behaviors measured in the study were based on declarations only and not an actual measurement of their behavior. In future research it would be worth examining actual behaviors, although such research would undoubtedly be very complex and expensive. Moreover, further research could also scrutinize the pro-ecological attitudes and behaviors in yet other countries with a different pro-ecological tradition and experience in order to see whether the differences observed between Poland and Belgium do indeed stem from the assumed experience. It would also be constructive to verify the hypothesis that

the high pro-ecological attitude indicators in Poland may result from self-presentation bias and, for this reason, to introduce such a control measurement.

Acknowledgements The presented research was carried out within the frame of the "Green Last-mile Delivery" (GLAD) project realized at the University of Warsaw with the following project partners: Colruyt Group, the University of Cambridge, and Technion. The project is supported by EIT Food, which is a Knowledge and Innovation Community (KIC) established by the European Institute for Innovation & Technology (EIT), an independent EU body under Horizon2020, the EU Framework Programme for Research and Innovation set up in 2008.

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Correction to: Decision-Making in Management: Methods and Behavioral Tools

Kesra Nermend, Małgorzata Łatuszyńska, and Eleftherios Thalassinos

Correction to:
K. Nermend et al. (eds.), *Decision-Making in Management*, Contributions to Management Science,
https://doi.org/10.1007/978-3-030-67020-7

Book editor's name was inadvertently published incorrectly in the online version. This has now been corrected through out the book as Eleftherios Thalassinos.

The updated version of these chapters can be found at:
https://doi.org/10.1007/978-3-030-67020-7
https://doi.org/10.1007/978-3-030-67020-7_4
https://doi.org/10.1007/978-3-030-67020-7_18

K. Nermend et al. (eds.), *Decision-Making in Management*, Contributions to Management Science, https://doi.org/10.1007/978-3-030-67020-7_20