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THE RELATIONSHIP BETWEEN ORGANISATIONAL FORESIGHT AND ORGANISATIONAL AMBIDEXTERITY

Doctoral dissertation

Doctoral Studies in Management and Administration (03S)

Vilnius

2013

Doctoral dissertation was prepared in 2009-2013 at ISM University of Management and Economics.

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ISBN 978-9955-792-44-4

PREFACE

If I have seen further it is only by standing on the shoulders of giants.
Isaac Newton

The four-year period it took to complete this dissertation has been a challenging but rewarding experience. First and foremost, I wish to thank my supervisor, Dr. Nerijus Pačėsa, for his guidance and consistent vision. I also wish to thank Professor Peter C. Bishop for his enthusiasm and critical insight, as well as Dr. Martin Amsteus for being available for advice and methodological discussions. I thank Dr. Antonio Brandão Moniz for his assistance during early stages of research, his dedication and warm personality are much appreciated. I want to express my gratitude to all the reviewers, committee members, professors and fellow students, and everyone who has provided comments or feedback. Last but not least, I would like to give sincere appreciation to my colleagues at Visionary Analytics and my family for their support and giving the needed encouragement throughout this journey.

Agnė Paliokaitė
October 2013

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DEFINITION OF KEY TERMS

Organisational foresight - ability that includes environmental scanning, strategic selection and integrating capabilities enabling the firm to detect discontinuous change early enough to interpret the consequences for the firm and formulate effective responses, while at the same maintaining a high-quality, coherent and functional forward view (Rohrbeck, 2010; Slaughter, 1996).

Environmental scanning capabilities - the extent to which a company employs external sources of information covering a stretch of time horizon from near to long term future that facilitates the recognition and market and technological opportunities.

Strategic selection capabilities - organisational routines consisting of analysing, visioning and planning in order to identify and move toward the preferred alternative for organisational change.

Integrating capabilities - the organisational leadership and coordination capabilities as well as the existing knowledge base required to create and capture value from opportunities.

Organisational ambidexterity - ability to pursue both explorative and exploitative innovation at the same time (Jansen et al., 2005).

Strong tie sources - sources of information from acquaintances in everyday work and/or that generate familiar information.

Weak tie sources - sources of information with which companies typically have little contact, but which can nevertheless provide new information (based on Ansoff, 1975; Hansen, 1999).

Time horizon - the time scale of environmental scanning– from short term (up to one year) to long term (up to more than 15 years) (Rohrbeck, 2010).

Depth of scanning - the scope of environmental scanning, including areas that appear to have little relevance but which could still breed disruptive changes with important consequences (Reger, 2001; Rohrbeck, 2010).

Analysing - interpreting the collected data on future conditions and describing baseline and alternative futures: drivers and uncertainties, implications and outcomes (based on Bishop et al., 2007).

Visioning - choosing a preferred future: envisioning the best outcomes and priority goals along with the performance measures to determine how much of those goals are being met (based on Bishop et al., 2007).

Planning - deploying organisational routines that ensure that actions, skills, and processes support the long term organisational vision (Grim, 2009).

Leadership - the degree to which senior management fosters the organisational culture open to wider vision.

Coordination - the capacity for formal and informal communication to share information and future insights (based on Rohrbeck, 2010)

Knowledge base - the stock of knowledge accumulated within the organisation, embodied by skilled human resources and gathered through in-house learning efforts (Guliani and Bell, 2005).

Explorative innovation - innovation directed at new and emerging customers or based on radically new technologies (Benner and Tushman, 2003; Jansen et al., 2005).

Exploitative innovation - innovation designed to meet the needs of existing customers or markets, based on refining and improving an existing technology or process, - a small change or a reconfiguration of an established system (Jansen, 2005).

Technological turbulence - the degree of change in product and process technologies in the industry in which a firm is embedded (Hanvanich et al, 2006).

INTRODUCTION

The inability to predict outliers implies the inability to predict the course of history.
Nassim Nicholas Taleb. The Black Swan: The Impact of the Highly Improbable.

The key focus of this dissertation is the relation between organisational foresight and explorative as well as exploitative innovation (organisational ambidexterity).

Relevance. A re-occurring theme within organisational literature is that successful organisations in a dynamic environment are ambidextrous – managing their business in an efficient way while at the same time adapting to the emerging changes in their environment (Duncan, 1976; Tushman and O'Reilly, 1996). Unland and Kleiner (1996) claim that the environment is continuously changing and evolving, hence businesses must change too or lose competitiveness. Change can take the form of abrupt and discontinuous shifts, or it can progress slowly through incremental advancements, like the largely unseen progress of brain-machine interfaces, which could impact fundamentally every aspect of our common life. Innovation both responds to and drives change, thus pro-actively shaping the future. Many findings reveal a positive relationship between innovation and firm performance (e.g. Garcia, 1998; Hansen, 2006; Nobelius, 2004). In particular, innovation- and technology-driven enterprises must continuously scan and monitor their environments in order to maintain their competitiveness and be able to develop new promising technologies and move them into new business fields (Rohrbeck and Gemuenden, 2011). Firms can focus on exploiting existing competencies or exploring new ones in their pursuit of innovation. Exploitative innovation is essential for generating short term results and, as a result, is the primary focus for many firms due its more certain outcomes (Christensen, Kaufman et al. 2008). In order to ensure long term survival, however, firms also need to explore new options in order to be ready for future changes in the environment. The challenge for firms is to ensure that current activities run efficiently to satisfy short term demands, and at the same time prepare for the future to retain long term competitiveness. The ability to pursue exploration as well as exploitation is referred to as *organisational ambidexterity* (Jansen et al., 2006). Empirical studies suggest that the combination of exploration and exploitation is associated with longer survival (Cottrell and Nault, 2004), better financial performance (Govindarajan and Trimble, 2005), and improved learning for innovation (Katila and Ahuja, 2002). Past

research on ambidexterity stresses the importance of the external acquisition of new knowledge for exploration (Raisch et al. 2009). Rosenkopf and Nerkar (2001) found empirical evidence that exploration beyond organisational boundaries had more impact on firm performance than exploration within organisations. Studies show that externally acquired knowledge may contribute to the reconfiguration of existing knowledge bases (Kogut and Zander, 1992; Henderson and Cockburn, 1994). Ambidexterity thus requires external search strategies and internal knowledge processes integrated across organisational boundaries.

The discipline of *organisational foresight* is largely concerned with ability to explore and exploit opportunities within and beyond the immediate value network or domain of existing operations. Foresight has therefore been identified as a strategic practice that can lead to organisational transformation and renewal especially in high uncertainty environments (Roubelat, 2006; Godet, 2001; Sarpong, 2010). By virtue of its ability to explore uncertainties and identify opportunities, organisational foresight can contribute to the exploration and capture of value to sustain competitive advantage (Bodwell and Chermack, 2010; Day and Schoemaker, 2004; Sarpong, 2010). A fundamental purpose of foresight is thus to minimise uncertainties or risks (Uotila et al., 2005) - by revealing the uncertainties and discussing their possible effects as well as possible responses to them, foresight minimizes the risk that unknown factors in the environment can harm the company. Moreover, scanning the environment is not the only role of foresight. Foresight has several roles – one of them is shaping the future through participatory techniques aimed at achieving consensus on the vision or strategy. Hence, it is also a reflection and knowledge-generating process and a vision-building and direction-setting process (Daheim and Uertz, 2006). Also, value is created, when foresight insights are turned into action and output, such as enhanced reaction to opportunities and threats, reduced uncertainty and successful innovations (Rohrbeck, 2010). With the rate of change increasing, the time to act becomes correspondingly short. As a consequence, planning becomes more than simply projecting the past into the future. Enterprises aiming at strategic agility and organisational ambidexterity need capabilities to detect and interpret changes in the environment by creating an early-warning system for disruptions and a consistent forward view for their business environment. Organisational foresight and its relationship to explorative and exploitative innovation is the focal point of this thesis.

Despite their practical relevance, however, the question becomes how foresight capabilities contribute to ambidextrous innovation.

Despite continuous development of the field of organisational foresight, most of the literature has not been theory-driven since many techniques have been developed simply to address specific issues (Salo et al., 2003). A review of the field reveals empirical research that has been limited to case studies, with some exceptions to test theory (e.g. Amsteus, 2011). In addition, most of the research has been inductive. Only some specific phenomena, such as the characteristics of environmental scanning, have been studied with deductive means (e.g. Danneels, 2008). Thus the research discipline has not reached maturity and is in a period of theory development. When the theory has not reached its maturity, the phenomena can be explained by importing other theories.

Three dominant theoretical lines appear in the literature at the intersection of organisational foresight and ambidexterity: evolutionary economics (Nelson and Winter, 1982), organisational learning (March, 1991), and dynamic capabilities (Teece et. al., 1997), all of which are based on the theoretical foundations outlined in a behavioural theory of the enterprise (Cyert and March, 1963/1992). These and related theories are employed as building blocks for the proposed research on the relationship between organisational foresight and organisational ambidexterity.

Research problem. The questions for this research stems from several research gaps as outlined below. Firstly, there is a *need to clarify the concepts*. The concepts (foresight, strategic foresight, corporate foresight, organisational foresight, technology foresight, managerial foresight, futures research, etc.) have been used in many contexts where they are often misinterpreted. Specifically, many researchers have attempted to define foresight (e.g. Amsteus, 2011; Major et al., 2001; Raimond, 1996; Ratcliffe, 2002; Slaughter, 1996). A number of related definitions of organisational foresight have been offered. The concept has also been employed to represent a collection of steps, exercises, studies, techniques or capabilities (Amsteus, 2011; Bishop et al., 2007; Grim, 2009; Horton, 1999; Rohrbeck, 2010). Consequently, it has not always been clear if and when foresight pertains to a process, a method, a property or a competence (Major et al., 2001). Moreover, as pointed out by Reger (2001) and Van der Duin (2006), other terms are commonly used instead of foresight, such as early awareness, weak signals collection, technology monitoring, technology watch,

technology forecasting, technology scouting or technology evaluation. In fact many of these synonyms only describe process steps (e.g. scanning and monitoring) or methods (e.g. scenario building) of organisational foresight. Other terms frequently used in the literature are technology intelligence, competitive intelligence and strategic intelligence, as well as futures research, futurology, prospectivism, futures study, futures management. Most of these terms reflect different subsets, functions or varieties of foresight.

Secondly, it *remains unclear what organisational parameters, behaviours or capabilities contribute to the success of organisational foresight*. Organisational foresight aims at identifying discontinuities, technological trends, emerging technologies, and future business opportunities in promising areas of strategic research (Martin, 1995; Reger, 2001), to provide early warning about potential threats, to support planning and shape strategy (Reger 2001, Bernhardt 1994), and trigger innovation (Rohrbeck, 2010; Gracht et. al, 2010). Empirical research based on case studies and explorative surveys confirm that, despite the perceived importance of foresight (Daheim and Uertz, 2006; Schwarz, 2007, Rohrbeck, 2010) the implementation of effective institutionalised foresight systems is limited (e.g. Becker, 2002; Reger, 2001; Rohrbeck, 2010). Secondly, the effectiveness of episodic foresight exercises remains low in practice. Although sensing and anticipating are not particularly difficult, building an organisational structure that facilitates an effective response has proven to be challenging (Rohrbeck, 2010). One possible explanation for this persistent gap between perceived importance and implementation could be, the lack of applicable knowledge and the lack of organisational incentives and capabilities that would foster the use of anticipatory information for generating effective responses (based on Rohrbeck et al., 2009; Rohrbeck, 2010). Only a few empirical studies have studied the effectiveness of foresight. Research is primarily driven by the aim to identify successful methods and processes. Most of authors have either studied organisational foresight as a process model (e.g. Daft and Weick, 1984; Ashton and Stacey 1995; Horton, 1999; Becker, 2002; among others) or as a method (e.g. Gordon and Hayward, 1968; Ono and Wedemeyer, 1994; Rowe and Wright, 1999; Phaal et. al. 2000; Porter et al., 2004; Lichtenthaler, 2005; Chermack, 2005; Mietzner and Reger, 2005; Van der Heijden, 2005; Rowe et al., 2005; Rohrbeck and Gemuenden, 2006; Quist and Vergragt, 2006; Popper, 2004, 2008; Daheim and Uertz, 2008; Schwarz, 2009; Abe et.al, 2009). Some scholars discuss the institutionalisation of

organisational foresight (e.g. Becker, 2002; Neef and Daheim, 2005; Daheim and Uertz, 2006; Rohrbeck, 2009, 2010; Vecchiato and Roveda, 2010). This research however builds on the work of Rohrbeck (2010) who suggested that effective foresight depends on organisational *capabilities* such as culture, organisation (e.g. integration of foresight activities within processes of innovation or strategic management), method sophistication (e.g. integration capacity), information usage (e.g. sources and scope), people and networks.

Thirdly, foresight is believed to have a positive impact on triggering explorative and exploitative innovation, but *empirical evidence on this relationship is lacking*. In recent times scholars drawing on various case studies and the extant foresight literature have attempted to show empirically how foresight practice (such as scenario building) could lead to innovation (e.g. Andriopolous and Gotsi, 2006; Clemons, 1995; Drew, 2006; Gracht, 2010; Noori et al, 1999; Partidario and Vergragt, 2002; Ruff, 2006; Sarpong, 2010; Van der Duin and den Hartigh, 2009; Van der Duin, 2006). While these studies have made an invaluable contribution to enriching understanding of the relationship between foresight and organisations' ability to innovate, most of them simply make grand connections between foresight or its specific methods and innovation but fail to show exactly how and when the practice may lead to innovation (Sarpong, 2010). Even though past research has striven to establish a positive relationship between foresight and innovation, this relationship has never been tested by higher constraint research designs. Nevertheless, the theoretical and empirical basis for such a relationship is becoming more apparent, and this study will build upon the limited platform of understanding in this area.

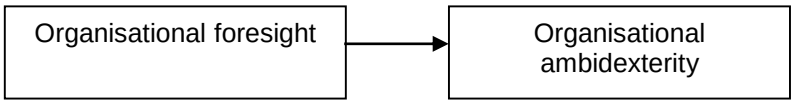
Most research concerning the relation between organisational foresight and innovation has focused on radical explorative innovation (e.g. Drew, 2006; Roveda and Vecchiato, 2006). However, Rohrbeck and Bade (2012) suggested that there is potential in researching the relationship between organisational foresight and both explorative (radical) and exploitative (incremental) innovation. The study by Middelbeek (2010) has shown that environmental scanning is positively and significantly related to ambidexterity, especially to explorative innovation. Gracht et al. (2010) suggested a dual role of foresight – while it can contribute to creatively generating new innovation ideas, it also helps evaluating the existing ones. Rohrbeck and Gemuenden (2011) identified examples in which foresight performing the strategist role has permitted the firm to explore and plan the development of new

business fields, and also showed how foresight performing the initiator role increases the ability to produce incremental innovation. These results suggest that foresight in support of innovation management can contribute to organisational ambidexterity.

Finally, *empirical work on organisational foresight has been limited to large multinational corporations*; investigations in small and medium-sized enterprises (SMEs) rarely play a role (Reger, 2001; van der Duin, 2004), although Jannek and Burmeister (2008) proved that SMEs are in substantial need of organisational foresight in order to be competitive. Neef and Daheim (2005) note that: 'small and medium sized enterprises (SMEs) are a white spot in organisational foresight research', even though their contribution to employment, value creation, and innovation is well recognized. It is assumed that the foresight needs of any company can be measured using several indicators. The more an enterprise is willing to change, the more it depends on foresight knowledge to provide security for investment decisions. The pressure to act is mainly the result of competition and innovation over relatively short timeframes. The study carried out by Jannek and Burmeister (2008) has revealed that even SMEs have substantial foresight needs due, not so much to long-term planning cycles, but rather due to high market and business environment dynamics and actors' shifting strategies. Their survey has shown that small and medium sized companies use basic but systematic foresight activities to support strategic planning and innovation management. This dissertation is among the first steps in the exploration of organisational foresight frameworks that could be applicable to any company.

The above outlined research gaps constitute points of departure for the proposed research study. The research gap is both theoretical and empirical. The questions are: 1) what organisational capabilities define organisational foresight, and 2) what is the relationship between organisational foresight and organisational ambidexterity. The key empirical research problem is depicted by Figure 1.

Figure 1. Research problem



The **research aim** is to determine the relationship between organisational foresight and organisational ambidexterity.

The domain of this dissertation is organisational foresight in Lithuanian manufacturing companies.

The objectives of the research are as follows:

1. To propose a conceptual definition of organisational foresight and to identify the key parameters of this construct.

2. To propose and test measures for organisational foresight and organisational ambidexterity.

3. To empirically examine the relationship between organisational foresight and organisational ambidexterity in Lithuanian manufacturing companies.

4. To propose a final conceptual model of the relationship between organisational foresight and organisational ambidexterity.

Research setting. The research setting is the manufacturing industry in Lithuania. Manufacturing is an attractive sector for this study for a number of reasons. According to Rohrbeck (2010), first, enterprises in manufacturing are challenged to perpetually present their clients with breakthrough solutions. Change and foresight-fullness are, therefore, inevitably part of their service and product offering. Second, this industry, especially the larger companies, high technology companies and those that are faced with industry clock-speed (Rohrbeck, 2010) embrace the challenges of not only developing but also sustaining foresight. These enterprises need to constantly 'stay ahead of the game' of product, process and technology innovation. The pressure is not only to foresee the future but often to define it. Thirdly, according to Schuz-Montag et al. (2010), companies in the manufacturing sector have a longer tradition and a more advanced approach to systematic future-oriented work than service or retail enterprises.

The Lithuanian manufacturing sector is currently faced with an increasing need for restructuring that requires foresight knowledge. This need stems from the long term global challenges (aggressive competition in the global business environment, in particular, the 'new economies', rising costs of key production factors, and science-based radical innovation breakthrough at a global scale, e.g. new materials) as well as from existing structure of Lithuanian industry and the prevailing competitiveness strategy still dependent on low costs. The latter strategy is losing its competitive edge very fast. A large part of Lithuanian industries operate in the less profitable parts of the value added chain, i.e. they sell raw materials, assembly services or production capacities, or manufacture low value-added products. Specific challenges faced by Lithuanian industry today are: to increase productivity and efficiency of business

processes in order to reduce costs; to increase the efficiency and synchronisation of the supply chain in order to achieve flexibility; to shift from mass production to mass customisation; and to move to the more profitable parts of the value-added chain, e.g. producing higher value added products, becoming brand owners and entering international value chains (Paliokaitė A. et al., 2013a, 2013b). The above-described challenges inevitably make industries search for ways to predict or to form the new market needs, better integrate new technological knowledge, quickly update the competences of the labour force, introduce new business models, and manage new production processes and systems. They also raise new expectations for high-quality management. The current status quo of Lithuanian industry makes it a suitable research setting for testing the proposed conceptual framework on organisational foresight and organisational ambidexterity.

Research strategy. The research strategy is based on the scientific philosophy of positivism. This philosophical approach to the creation of knowledge is characterised by an emphasis on empiricism – that knowledge is based on empirical observation, the test of theories and the development of universal laws. Most of the research in foresight to date has been inductive, thus aimed at theory development. Current knowledge in the field of organisational foresight and its link to innovation has taken the form of previous and increasing numbers of theoretical writings. Consequently, as the concept has already been addressed through lower constraint designs, the refinement of research questions to allow higher constraint was deemed central, in order to move from theory development phase to theory testing (ct. Amsteus, 2011).

The selected approach suggested a quantitative design for this research. A three-phases research design was applied, based primarily on a quantitative survey as a main instrument. Firstly, a comprehensive conceptual framework was developed following an in-depth literature review. Secondly, a measurement scale for validating the model was elaborated and validated via a pilot study on a small sample of companies. Thirdly, a multivariate survey was carried out for testing the research hypotheses. The data was collected from a sample of managers of 230 manufacturing companies registered in Lithuania. For the purposes of data analysis, exploratory factor analysis, confirmatory factor analysis, correlational and regression analysis and non-parametric tests performed with SPSS 21.0 and Stata 12.0 were employed.

Theoretical contribution and managerial implications. This dissertation contributes to the theoretical conceptualisation of organisational foresight by defining it as a set of organisational capabilities. By reviewing the existing body of knowledge on organisational foresight and strategic management, this study attempts to broaden the understanding of organisational foresight by describing it as an organisational capabilities framework as opposed to foresight only as a process model or a set of certain methods. The proposed conceptual model integrates the research streams that focus on different subsets or features of organisational foresight. It advocates for an integrative approach to organisational foresight as an everyday practice, where foresight methods, processes and competences are not mutually exclusive - a process can contain a series of methods, and methods and processes can be used to achieve a capability. Hence, the key proposed contribution of this dissertation lies in the development of the organisational foresight construct. Organisational foresight construct has been defined precisely enough to allow quantitative measures to be developed.

The dissertation contributes to the development of a valid organisational foresight scale. It is one of the first attempts to advance organisational foresight into a quantitatively measurable concept. Proposed contributions permit a more unified research approach, and thus the promotion of future progress in the discipline. The organisational foresight scale comprised of the second order environmental scanning, strategic selection and integrating capabilities with their constituting first order capabilities allow to assess and compare all types of companies in terms of the degree to which they have established organisational foresight. The previous foresight research has been limited to large multinational corporations (Jannek and Burmeister, 2008). The organisational foresight scale is an important step towards developing testable constructs and hypotheses and thus leading the transition to deductive research and theory testing. The dissertation also points out to the remaining limitations and provides propositions for further development of the scale.

The quantitative study carried out by this dissertation provided empirical evidence on the theoretically assumed positive relationship between organisational foresight and organisational ambidexterity (explorative and exploitative innovation). This contribution serves as empirical basis for further research in the direction of exploring and explaining causal links between organisational foresight and innovation or ambidexterity. Importantly, this dissertation also provided empirical evidence on the

moderating effects of integrating capabilities. The organisation's coordination capabilities as well as its knowledge base were found to be significant intermediary factors in taking advantage of environmental scanning.

This study not only serves the academic purpose of developing knowledge regarding organisational foresight, but also aims to illustrate practical, management-oriented aspects of the concept. The proposed model of organisational foresight capabilities can be used for advancing management practices and capabilities in companies. This dissertation argues that organisational foresight should not be seen as a 'one-off' episodic intervention, but rather as an everyday practice intentionally or implicitly used by organisational actors. This approach should stimulate companies to look beyond the short- and medium-term planning horizon in strategy development, to strengthen their organisational foresight capabilities and to take better advantage of opportunities and defend against threats in the long run. Effective management of those capabilities could lead to the identification of novel opportunities for innovation. Overall, the results of this research propose how companies can use change to innovate incrementally and transformationally and thereby shape the future with novel technologies, products and services. Empirical evidence is provided on which foresight capabilities contribute to exploitative (incremental) and which to explorative (radical) innovation. This knowledge could be used for industrial applications as guidance on which route to follow and which capabilities to nurture for better innovation outcomes. The empirical findings confirmed that integrating capabilities (coordination and knowledge base) are paramount for exploiting and assimilating the value of new information generated from external sources – when these capabilities are weak, much of the potential value of environmental scanning can be lost.

Research limitations. There are methodological and theoretical limitations implied by the chosen research design. Firstly, the proposed conceptual model of organisational foresight capabilities is limited to the organisation's perspective. Hence, a body of knowledge on cognitive and behavioural characteristics, and other (e.g. managers', employees', networkers', foresighters') characteristics is excluded from this study. Second, organisational foresight and organisational ambidexterity are assessed as and limited to perceived foresight and ambidexterity as it is perceived (and reported) by managers themselves. Third, the assessment is confined to the boundaries of the measurement instrument and the selected variables. Translation of

the theoretical organisational foresight construct into the constraints of the measurement instrument is limited by a trade-off between flexibility, precision, theoretical and practical considerations. Fourth, the research focused on a limited sample of economic sectors in a limited geographical territory described as a catching up economy. Only manufacturing enterprises registered in Lithuania were included in a study. Sampling across all sectors in the economy was considered too difficult to accomplish. Fifth, the smallest companies (up to 50 employees) were excluded from the study, because it was assumed that in these companies the managers' personal characteristics would have higher impact on enterprise performance (e.g. Lefebvre, et al. 1992, 1997) than the organisational capabilities defined in the conceptual model. Sixth, the causal or longitudinal relationship between organisational foresight capabilities and organisational ambidexterity are limited as the study has collected only cross-sectional data. A causal sequence from organisational foresight to explorative and exploitative innovation can only be assumed. Finally, the validation of the construct validity of the organisational foresight construct could be further improved. Structural equation modelling was not applied to a full extent due to a limited sample and other limitations. The reliability of the knowledge base scale is also limited. Further research is needed to improve the scale.

Structure of the dissertation. The first Chapter serves as an introduction to the dissertation and contains a roadmap that clarifies the research problem and research objectives. In the second Chapter (literature review), past research is discussed in order to identify past empirical findings on which the research has been built and in order to define the research questions more specifically. In addition, the second part includes the discussion of the theoretical foundations of the research and demonstrates clearly the expected contribution of the proposed research. The third Chapter provides a description of the proposed theoretical model and the hypotheses on the structural relationships in it. The fourth Chapter reviews the methodology of the proposed research and explains the rationale for the selected methods. The fifth Chapter contains the results of the empirical research and evaluates the validity and reliability of the results. Also, the research process is described in detailed way in this Chapter. The final Chapter is the concluding chapter. Here the concluding statements and answers to the research question are discussed, and the recommendations for practice as well as suggestions for future research are presented.

Publication and presentation of research findings

Presentations in international conferences:

Paliokaitė A. (2011). Routes for enhancing organisational foresight capabilities in small and medium sized enterprises. Yeditepe International Research Conference on Foresight and Futures YIRCOF'11 'Theory Building in Foresight and Futures Studies', August 2011, Istanbul, Turkey.

Paliokaitė A. (2012). The relationship between organisational foresight and product innovation in small and medium sized enterprises. 8th International Globelics Academy 'National Systems of Innovation and Economic Development', August 2012, Redesist / Economics Institute, Federal University of Rio de Janeiro, Rio de Janeiro, Brazil.

Paliokaitė A. (presenting author), Martinaitis Ž., Reimeris R. (2013). Foresight methods for Smart specialisation strategy in Lithuania. International Foresight Academy 2013. Academic Seminar 'Participatory Foresight for Smarter Futures – From Design to Impact'. September 2013, ZHAW, Winterthur / Zurich, Switzerland.

Publications in international peer-reviewed scientific journals:

Paliokaitė A. (2010). Industry level foresight: Designing foresight methods for Lithuanian energy sector. *Enterprise and Work Innovation Studies*, 6, IET, 9 – 51.

Paliokaitė A., Pačėsa N., Sarpong D. (2013). Strategic foresight in practice: a capabilities based framework. Accepted for Special Issue on 'Theoretical and empirical foundation underlying Organisational foresight', *Strategic Change,* ISSN: 1099-1697.

Paliokaitė A., Martinaitis Ž., Reimeris R. (2013). Foresight methods for Smart specialisation strategy in Lithuania. Accepted for 'Special Issue on Participatory Foresight and Technologies', *Technological Forecasting and Social Change,* ISSN: 0040-1625.

Paliokaitė A., Pačėsa N. (2013). Relationship between organisational foresight and ambidextrous innovation. Submitted for 'Special Issue on Corporate Foresight', *Technological Forecasting and Social Change,* ISSN: 0040-1625.

1. CRITICAL LITERATURE REVIEW

Men love to wonder, and that is the seed of science. Ralph Waldo Emerson

1.1. THEORETICAL LENSES OF THE STUDY

The key concepts of interest in this study are *organisational foresight*, which comes from the fields of futures research and strategic management, and *innovation*, which comes from the field of innovation and technology management. When examining the combination or the intersection of these research streams, three mainly dominant theoretical lines appear in the literature: *evolutionary economics* (Nelson and Winter, 1982), *dynamic capabilities* (Teece, 1997, 2007) and *organisational learning* (March, 1991), all of which are based on the theoretical foundations outlined in a *behavioural theory of the enterprise* (Cyert and March, 1963). In their article on the future research directions for environmental scanning, futures research, strategic foresight and organisational future orientation, Rohrbeck and Bade (2012) proposed that the theoretical frameworks of strategic management can be used to advance the field of organisational foresight and that the theoretical frames of dynamic capabilities and *organisational ambidexterity* can be expected to be particularly useful. In the subsequent sections these theories are briefly explained.

2.1.1. Evolutionary economics and dynamic capabilities

Evolutionary economics is one the most influential theory constructs in contemporary management research (Ramos-Rodriguez and Ruiz-Navarro, 2004), and it is particularly relevant with respect to both innovation research (Fagerberg and Verpagen, 2009) and organisational foresight. As a direct descendent, it owes many of its concepts and most of its philosophy to a behavioural theory of the enterprise (Cyert and March, 1963). One of the links between both theories is the understanding of repeated operations or routines, which became the foundational building blocks of the capabilities theories, in general, and on dynamic capabilities in particular (Winter, 2003; Teece et al, 1997). Evolutionary economics views organisational evolution as agents using a set of routines that change incrementally through search rather than as a result of optimisation (Nelson and Winter, 1982). The basic propositions are that (a) enterprises are profit seekers and not profit maximizers; (b) they are not limited by a

fixed set of possibilities which they can optimise, but they can innovate and create new opportunities and possibilities; (c) they are based on stable practices (routines) which define their activities over time; (d) they are the holders of organisational and technological knowledge, and knowledge is therefore the key agent of change; and (e) most importantly for this study - search processes are the basis for technological and organisational innovation. Search activities may be delineated as activities that scan the external environment in order to find either alternatives to existing routines or new routines (Saviotti and Mani, 1998). Hence, enterprises develop heterogeneous sets of capabilities and sustain (or modify) them over time (Argote and Greve, 2007), and they search (or scan) their environment for new knowledge for innovation.

A central point in evolutionary theory is the path-dependent nature of routines (Argote and Greve, 2007), a key element of research on innovation and organisational change (Helfat, 1994; Katila and Ahuja, 2002). Another frequent assumption is that local search significantly restricts the course of research and development, and therefore innovation (Stuart and Podolny, 1996).

From an evolutionary perspective, organisational foresight has been referred to as the ability to imagine or simulate the future (Amsteus, 2011). Analysis of the environment and the firm in terms of variation, selection and retention, as well as the match or fit at as many levels as possible, across time, is central to foresight (Amsteus, 2011). Organisational foresight can also be called part of the search and change strategy. From the evolutionary perspective, some see organisational foresight as a dynamic capability (Rohrbeck, 2010), aspects of the crucial mechanisms for adding, shedding, and renewing organisational resources and their operational capabilities (Teece et al., 1997; Teece, 2007; Eisenhardt and Martin, 2000).

2.1.2. Organisational learning and ambidexterity

March and Simon (1958) introduced key concepts which later became the basis of the organisational learning theory by rejecting the claim of economic rationality and that organisational decisions are uniquely determined by environmental constraints. They argued that organisational behaviour depends on complex internal processes which add unpredictably to the decision-making process. They described the enterprise as a complex adaptive system, though that term was not used at the time.

In particular, the role of search and aspiration and the importance of routine-based behaviour are central to organisational learning (Gavetti et al., 2007).

The research on organisational learning produced an enormous amount of studies and research streams. Several scholars have tried to systematise the body of knowledge on organisational learning. For example, Huber (1991) classified organisational learning in a system with four main categories: (1) knowledge acquisition, (2) information distribution, (3) information interpretation and (4) organisational memory. The model of organisational learning developed by Crossan, Lane, and White (1999) suggests that organisational learning encompasses four processes (the '4Is): (1) intuiting, (2) interpreting, (3) integrating, and (4) institutionalising, that allow learning to feed forward to the organisational level and feed back to the individual.

The works of March (1991) on explorative and exploitative learning strategies and of organisational ambidexterity (Duncan, 1976; Tushman and O'Reilly, 1996) are most relevant for the purposes of this research. One of the more enduring ideas is that an organisation's long-term success depends on its ability to exploit its current capabilities while simultaneously exploring fundamentally new competencies (March, 1991). Exploration is captured by the terms of search, risk taking and discovery and refers to radical innovations that are designed to meet the needs of emerging customers and markets (Danneels, 2002). It departs from established systems of production, and opens up new linkages to markets and users, offers new designs, and develops new channels of distribution (Abernathy and Clark, 1985). Hence, exploration departs from existing knowledge. Exploitation refers to incremental innovations that are designed to meet the needs of existing customers or markets (Jansen, 2005). It involves change that builds on established competences and focuses on improving established designs, introducing modifications to existing products and services, and increasing the efficiency of existing distribution channels (Abernathy and Clark, 1985). From a resource based view (e.g. Penrose, 1959), the ability to pursue exploitation and exploration simultaneously is considered a valuable, rare and costly capability to imitate. The challenge for firms is thus to both ensure that current activities run efficiently to satisfy the short term demands and to prepare for future competitiveness.

The ability to pursue exploitative and explorative learning strategies at the same time is referred to as organisational ambidexterity. Earlier studies often regarded the trade-offs between these two learning strategies as insurmountable, but more recent

research (e.g. Tushman and O'Reilly, 1996, 2004) describes ambidextrous organisations that are capable of simultaneously exploiting existing competences and exploring new opportunities. Building upon earlier work by Duncan (1976), Tushman and O'Reilly (1996) were the first to present this theory. Several studies have focused on the competitive benefits of ambidexterity and found that achieving high levels of both exploration and exploitation results in sustainable advantages that improve organisations competitiveness (e.g. Jansen, van den Bosch et al. 2005, Gibson and Birkinshaw 2004). Understanding how to achieve ambidexterity through organisational antecedents, however, is still limited. The research by Middelbeek (2010) showed that environmental scanning is positively and significantly related to ambidexterity, especially to explorative innovation. The aim of this research is to extend the understanding on how ambidexterity can be achieved by cultivating the organisational foresight capabilities (Scanning is but one of them.) by testing the relation between organisational foresight capabilities and ambidexterity. The latter two concepts are discussed in detail in Chapters 2.2 and 2.3.

2.2. ORGANISATIONAL FORESIGHT

You can analyse the past, but you need to design the future. That is the difference between suffering the future and enjoying it. Edward De Bono.

The primary interest of this research is in organisational (enterprise level) foresight as opposed to managerial foresight (level of individuals) and foresight at the policy (macro) level. This chapter is divided into four sections. The first provides an introduction to the concept of organisational foresight (OF) and introduces alternative approaches to it. The second discusses institutionalisation and the 'episodic' approach. The third presents OF as a futures methodology. The fourth discusses the process approach, and the idea of viewing organisational foresight as a future related knowledge management process is explored. The fifth introduces OF as a capability, and the sixth presents the integrative organisational foresight capabilities framework.

2.2.1. Introduction to the concept of organisational foresight

The importance of foresight to strategic management was acknowledged by Fayol (in 1919), Knight (in 1921) and Whitehead (in 1967) as early as the first part of the 20th

century (Sarpong, 2010). Foresight has been promoted and discussed as a tool or competence for enhancing innovation and change at various levels (Patton, 2005), in comparison or in contrast to incremental improvements and inertia. The general goal of organisational foresight is to create awareness about the external environment and to enable strategies to react to those changes (Patton, 2005). It aims at identifying discontinuities, technological trends, emerging technologies, and future business opportunities in promising areas of strategic research (Martin, 1995; Reger, 2001), and to provide early warning about potential threats, to support planning and shape strategy (Reger 2001, Bernhardt 1994).

Some scholars suggest that foresight (managerial or organisational) should be positioned within the field of business economics and strategy (e.g. Amsteus, 2011). Others argue that foresight is part of the field of futures studies or futures research. The discussion whether this field has reached maturity is ongoing. The term *future research* is used as a term to describe the whole range of research conducted to help organisations, individuals, and governments explore, prepare for, and respond to changes in the environment. Hence, the terms future studies or future research is used in a broader sense for any research aimed at identifying ways to make sense of or to describe alternative future directions (Gordon et al., 2005). Rohrbeck and Bade (2012), after reviewing the future-related studies produced over the last 30 years, claim that the starting point for futures research is the paradigm that corporate planning under uncertainty needs to move away from forecasting and predicting towards identifying multiple possible futures. Multiple futures are used to plan flexible strategies, increase strategic agility or assess the robustness of the firm's strategy (Rohrbeck and Bade, 2012). Hence, it can be argued that futures research is a branch in the field of strategic management.

According to Rohrbeck (2010), it is the research stream on *environmental scanning* that produced the foundation for organisational foresight by developing the concept of weak signals and identifying the environment as the source of future-oriented information. Igor Ansoff was among the first scholars who observed the inherent ignorance of companies towards changes in the environment, resulting in their frequently missing of opportunities and threats. Such changes can be identified and anticipated by scanning for so-called *weak signals* (Ansoff et al., 1975). Early identification of the emerging signals increases the time for enterprises to act strategically instead of just engaging in short-term response. The key challenge is how

to interpret these signals when perceived. Another challenge is to decide which ones to interpret because the number of signals is usually larger than an enterprise can handle. Equally important is the concept of *discontinuities* that Ansoff introduced and later developed under the term *disruption* (Ansoff, 1980). Discontinuities are characterised as major shifts that are threats or opportunities depending on the perspective and the reaction of the organisation's management. A related concept is a *wild card,* a highly influential event that brings discontinuous change. Ansoff originally founded this stream as *strategic issue management*; after that the field was called *environmental scanning* (Ansoff, 1980). A study by Danneels (2008) demonstrated that environmental scanning influences the ability of an enterprise to build new competencies such as managing discontinuous change. Empirical evidence was collected that indicates that high-performing enterprises scan more frequently, use a larger variety of information sources, and tailor their scanning systems to fit the context of the enterprise (Daft et al., 1988, Yasai-Ardekani and Nystrom, 1996).

The investigation of the future from an organisational perspective was further developed under the term of strategic foresight and also sometimes referred to as corporate or *organisational foresight* (Becker, 2002; Ruff, 2006). Strategic foresight was defined by Richard Slaughter as the ability to look forward and to use the insights in organisationally useful ways, such as shaping strategy or defining new markets, products, and services (Slaughter, 1996). Others define foresight as a process, which identifies future developments in science, technology, economy, and society systematically before these developments become trends (Coates, 1985, Martin 1995, Porter, et al. 2004, Reger 2001). This process involves methods and techniques to gather, assess, and interpret relevant information and to support decision-making (Coates, 1985, Cuhls, 2003). Some argue that the term foresight is used to differentiate against forecasting which predicts the development of a known trend or issue, as foresight is aimed at identifying new emerging issues for which often no past data is available and therefore forecasting would not be possible (Rohrbeck, 2010). Others (e.g. Bishop et al, 2007a, 2007b; Grim, 2009) claim that forecasting is a subset of foresight that describes multiple futures, and prediction based on past data is the extrapolation of only one future, usually the most probable.

As observed by Amsteus (2011) and Martelli (2001), the lack of theory development in the field of foresight, coupled with subtle contradictions in definitions has led to the explosion of numerous conceptualisations of strategic foresight. As a

consequence, the term of foresight is still vaguely defined. The research on organisational foresight is the research discipline that has not reached maturity yet as it has aimed mostly at theory building and not theory testing (Rohrbeck, 2010). As it is often with new research disciplines, it has been conducted using different definitions. Many scholars have aimed to differentiate terms used in this broad field (e.g., Van der Duin, 2006; Rohrbeck, 2010). So far, the attempts to develop a common definition have not produced much clarity. Specifically, researchers have discussed the meaning or definition of foresight (e.g. Amsteus, 2008; Major et al., 2001; Raimond, 1996; Ratcliffe, 2002; Slaughter, 1996). A number of related definitions of have been offered and the concept has been deployed to represent a collection of steps, exercises, studies, techniques or capabilities (Amsteus, 2011; Horton, 1999; Rohrbeck, 2010). Consequently, *it has not always been clear if and when foresight pertains to a process, a method, a property or a competence* (Major et al., 2001; Rohrbeck, 2010; Amsteus, 2011). Some scholars define it as a process (e.g. Becker, 2002) and others define it as ability of an enterprise or even of an individual manager (Slaughter, 1996; Rohrbeck, 2010; Amsteus, 2011). One reason for the lack of commonly agreed and clearly used terminology may be that research is driven by various perspectives, with different scholars focusing on different facets of the concept (Amsteus, 2008). Hence, there is the lack of interchange and cross-referencing between the different research streams. The cross-functionality is stressed in Richard Slaughter's definition of strategic foresight: 'Strategic Foresight is the ability to create and maintain a high-quality, coherent and functional forward view, and to use the insights arising in useful organisational ways. For example to detect adverse conditions, guide policy, shape strategy, and to explore new markets, products and services. It represents a fusion of futures methods with those of strategic management' (Slaughter, 1996, p. 287).

The majority of scholars view organisational foresight as a futures methodology, hence research is still driven by the aim to identify successful methods and processes (see Table 1). Some investigated institutionalisation of foresight in large enterprises. Rohrbeck and Bade (2012) argued that unifying frameworks are needed to reflect the full potential for organisational foresight. Only three unifying organisational foresight frameworks have been produced so far by Peter C. Bishop and Andy Hines (2007a), Terry Grim (2009) and Rene Rohrbeck (2010). While the first two models adopt a project-based ('episodic') approach to foresight, Rohrbeck (2010) argues that

organisational foresight should be embedded in the everyday activities of an organisation and should rather be seen as a set of capabilities instead of one-off strictly defined event or a clearly separated system.

Table 1. Approaches to organisational foresight

Approach to OF	Author / study
Foresight as a futures methodology or separate methods, e.g. roadmaps, scenarios, Delphi, relevance trees, cross impact analysis, simulation modelling, systems dynamics, game theory, trend extrapolation, expert panels, among others	E.g. Gordon and Hayward, 1968; Ono and Wedemeyer, 1994; Rowe and Wright, 1999; Phaal et. al. 2000; Porter et al., 2004; Lichtenthaler, 2005; Chermack, 2005; Mietzner and Reger, 2005; Van der Heijden, 2005; Rowe et al., 2005; Rohrbeck and Gemuenden, 2006; Quist and Vergragt, 2006; Popper, 2004, 2008; Daheim and Uertz, 2008; Schwarz, 2009; Abe et.al, 2009
Process approach, i.e. foresight as a process, consisting of three to six steps	E.g. Daft and Weick, 1984; Ashton and Stacey, 1995; Horton, 1999; Becker, 2002; Reger 2001; Bishop and Hines, 2007a, among others.
Institutionalisation approach	E.g. Becker (2003), Neef and Daheim (2005), Daheim and Uertz (2006); Rohrbeck, 2009, 2010; Vecchiato and Ravena, 2010
Integrative frameworks	Organisational future orientation maturity model by Rohrbeck (2010); Bishop and Hines (2007a); foresight maturity model by Grim (2009).

Source: compiled by the author

The next sections review the proposed alternative approaches to organisational foresight.

2.2.2. Organisational foresight as a futures methodology

For many years, strategic foresight has been conceptualized as a futures methodology. This research stream is focused primarily on establishing knowledge about method usage (Jain, 1984) and giving recommendations to managers on which method to choose and in which context (Lichtenthaler, 2005; Porter et al., 2004; Popper, 2008). A number of scholars work specifically on enhancing individual methods, such as: the scenarios (e.g. Chermack, 2005; Mietzner and Reger, 2005; Van der Heijden, 2005, among others); Delphi (e.g. Ono and Wedemeyer, 1994; Rowe and Wright, 1999; Rowe et al., 2005, among others); cross-impact analysis (e.g. Gordon and Hayward, 1968; among others); backcasting (Quist and Vergragt, 2006); gaming (Schwarz, 2009); roadmapping (e.g. Phaal et. al. 2000; Abe et.al, 2009, among others), etc. The Foresight Diamond elaborated by Popper (2008) lists 34 different foresight methods, but the list is not definite.

As the *methodological approach* is concerned, future-oriented activities may largely differ in terms of complexity and sophistication. While some of them essentially rely on qualitative approaches and inputs, i.e. experts' opinions (qualitative techniques), others make extensive use of statistical and computational tools (quantitative techniques). A further relevant distinction concerns the explorative vs. the normative nature (and use) of foresight methods (Porter et.al, 2004). Explorative techniques generally deal with questions that regard what might possibly happen as the result of the forces at play. Such techniques begin with the past and the present as a starting point and move toward the future in a heuristic manner, by looking at conceivable possibilities. Normative techniques are goal-oriented, as they tend to take into account the purpose of the organisation, its mission, and, most of all, its expected achievements and outcomes. So normative techniques tend to move backwards in order to understand whether the objectives can be actually pursued, given the capabilities available by the organisation.

The selection of the right method(s) is essential in order to make valid decisions. There is a difference in which methods are being discussed from different research perspectives. On the *micro level*, especially roadmapping, scenario planning, and technology scouting are discussed frequently, while literature with a *macro perspective* most often deals with the Delphi method and expert panels (Lichtenthaler, 2005). In his 'foresight diamond' model Popper (2008) describes two fundamental 'attributes' of foresight methods: (a) nature; and (b) capabilities. With regards to their *nature*, methods can be characterised as qualitative, quantitative or semi-quantitative:

- *Qualitative methods* generally provide meaning to events and perceptions. Such interpretations tend to be based on subjectivity or creativity that is often difficult to corroborate, for example opinions, judgements, beliefs, attitudes, etc. There are 15 qualitative methods according to Popper (2008): backcasting, brainstorming, citizens' panels, environmental scanning, essays, expert panels, futures workshops, gaming, interviews, literature review (LR), morphological analysis, questionnaires/surveys, relevance trees, scenarios, and SWOT analysis.
- *Quantitative methods* generally measure variables and apply statistical analyses, using or generating – at least in theory – reliable and valid data, such as socio-economic indicators. The mapping considered three quantitative methods: bibliometrics, modelling/simulation, and trend extrapolation/megatrends (or simply extrapolation).

- *Semi-quantitative methods* are basically those that apply mathematical principles to quantify subjectivity, rational judgements and viewpoints of experts and commentators, i.e. weighting opinions and probabilities. The mapping included six methods from this category: cross-impact/structural analysis, Delphi, key technologies, multi-criteria analysis, stakeholder mapping and (technology) roadmapping.

Interestingly, the research available suggest there has been a shift in approaches to organisational foresight since the 50s-60s. Van der Duin (2004), Danheim and Uertz (2008) and Rohrbeck (2010) compared the evolution of future research in enterprises with their innovation processes. In their analysis, they show that corporate innovation focused on technologies in the 1950s and 1960s as their way of exploring the future. As the innovation processes changed over time to include the market perspective and later networking as a way to boost the enterprise's own innovation capacity, so did the foresight activities. In the 50s up to the 80s futures research aimed particularly at forecasting future developments by using S-curves, mathematical modelling, and Delphi studies. In the 1990s, the limitations of forecasting became apparent, and future research moved away from attempting to predict the future toward identifying possible, probable, plausible, and preferable futures (Rohrbeck, 2010).

Contemporary research on organisational foresight claims that organisational foresight is represented by four different modes (Cunha, 2004; Fonseca, 2002; Daheim and Uertz, 2008). The *expert-based* foresight emphasises expertise; it explores change by the use of Delphi, roadmaps and scenario techniques that involve experts. *Model-based* foresight aims at calculating change by using quantitative and 'subjective' models and matrices. *Trend-based* foresight aims to react to change and emphasises projection and development; its main components are trends, weak signals, early warnings, and the development of trend-databases and monitoring systems. Daheim and Uertz claim that nowadays the latter is a predominant mode of foresight activities at the corporate level (2008). Another stream views organisational foresight as the interaction between the way people simultaneously construe and are constrained by the temporal structures that are both enacted and changed through practice (Cunha, 2004). This pro-active ('shape the future') than reactive approach relates to the concept of '*open*' ('collaborative', 'participatory') foresight and is expected to be the next generation of organisational foresight (Daheim and Uertz, 2008).

Table 2. Development of approaches to organisational foresight

Dominant OF-Paradigm	Expert-based Foresight	Model-based Foresight	Trend-based Foresight	Context-based 'Open' Foresight
Assumption: The future can be ...	Known by means of expertise	Calculated by means of models	Projected by means of (scanned) developments	Shaped by means of interaction
Key Characteristics	Belief in Experts dominant, but: 70s: Turn to the qualitative and wider environment First Opening towards 'soft sciences'	Quantitative and 'subjective' Models Extrapolation Systems Dominated by 'hard science'	Trends Weak Signals Early Warning Mix of qualitative and quantitative Indicators	Integrating 'soft' and 'hard' approaches. Understanding and Interpreting / evaluating change. Opening up: Participation, Interaction and process. Action- and innovation-oriented. More attention on discontinuities
Perspective	Exploring Change	Calculating Change	Reacting to Change	Understanding and Anticipating / Shaping Change
Output	Delphis, Roadmaps, Scenarios	Models and Matrixes	Trend-databases, Monitoring Systems	Scenarios; Wild Cards; Action Plans and Innovation Ideas

Source: Daheim and Uerz, 2008.

Overall, therefore, there are descriptive / objective (e.g. analysis of statistics) and active / subjective components (e.g. involvement of experts, employees, customers) in the set of foresight methods. The subjective (human) component in understanding future is as important as the objective component. In order to ensure the success of foresight activities, experts and decision makers need to be integrated into the process (Barker and Smith, 1995; Rohrbeck, 2010, Daheim and Uertz, 2008). To do so, motivation mechanisms need to be put in place to meet the expectations of each stakeholder and be aligned to the corporate context (Salo, 2001). In addition, it has been argued that the dominant logic in organisations hinders the acknowledgement of change and hinders acceptance of alternative development paths. The task of organisational foresight, therefore, is to challenge the basic assumptions in the firm by running participatory foresight exercises (Blackman and Henderson, 2004). Additional benefits of using participatory methods to explore possible futures arise from the process itself. It has been shown that the process of scenario planning can play the role of strategic conversation (Chermack et al., 2006) and enhance organisational

learning (Rohrbeck, 2010). There has also been a shift in strategic management from 'strategic planning' to 'strategic thinking', although companies tend to do both. In summary, there is a shift from environmental scanning serving strategic planning primarily by focusing on predicting change to organisational foresight serving strategy and being focused on exploring possible changes (Rohrbeck, 2010) and shaping the future with the help of participatory methods.

2.2.3. Institutionalisation versus 'episodic' approach to organisational foresight

Another stream of conceptualising organisational foresight focuses on its form of organisation. The 'episodic approach' to strategic foresight dominates this research stream. Empirical evidence suggests that typically a foresight exercise, focused on a specific field such as science and technology for R&D planning, is carried out on an 'ad-hoc' basis and relies on the contribution of external experts, futurists or facilitators, who deliver a comprehensive investigation of many different fields in the business micro- and macro- environments. To organise such an exercise, firms either set up an internal temporary task force observed by Becker (2002) or engage in multi-client foresight projects financed by several firms, governmental bodies or business associations in order to cope with some very complex issues of common interest (Vecchiato and Roveda, 2010). Most common characteristics of these 'episodic' foresight exercises is that they are project- based (hence, have a predetermined timeframe) and are facilitated by external consultants.

Despite empirical attempts to look for institutionalised foresight (e.g. Becker, 2002; Reger, 2001), where dedicated units direct the foresight activities and foresight is linked to other organisational functions and processes, such institutionalisation is a rare practice even in large firms. Slaughter (2009) suggests that 'integration of this work appears to be rare at every level.' In his case study research on multinational firms, Rohrbeck (2010) found that although he was able to identify various best practices in specific dimensions, none of the firms had implemented a comprehensive, stable and effective strategic foresight system. More importantly, he concluded that formal institutionalised foresight units, if they are separated from the firm's other units, do not work because the system does not know what to look for or what to do with what it finds.

Nevertheless, the literature identifies several forms of institutionalising and/or organising foresight (Table 3).

Table 3. OF institutionalisation and/or organisation forms

Institutional forms	Description	Source
Collecting Post (Lufthansa, PandG, Volvo)	In enterprises with a comparatively low degree of foresight activities, future-related research is mostly done in conjunction with – and strongly embedded in – other strategic R&D activities. Because of the relatively low need for foresight input, the persons responsible for foresight are just part-time 'futurists', (i.e. foresight is only one of their several tasks) and thus only seldom form a separate unit, i.e. a lot of future-related knowledge is just 'bought' from the outside. Relatively low visibility in the enterprise and are known only to those who are directly involved in it.	Becker (2003), Neef and Daheim (2005), Daheim and Uertz (2006)
Observatory (DB, IBM, Eni)	An autonomous foresight unit with a full-time staff and a budget of its own. Moreover, it also has a clear mandate to focus on future-related issue. Be it the identification of socio-economic forecasts (in the case of the Enterprise C foresight group) or forecasts of future traffic flows (in the case of the Deutsche Bahn). It also has a single addressee in the enterprise - in most of the cases, the corporate development department. These networks are mostly made up of specialists from the same or similar fields of expertise, and only seldom tap into the broader areas of foresight.	Becker (2003), Neef and Daheim (2005), Daheim and Uertz (2006)
Think tank (Ericsson, British Telecom, BASF, Decathlon, EdF, DaimlerChrysler, Philips)	The most broad and elaborate foresight work is done by special units who act as a forward-looking think tank for their enterprise, i.e. a group of full-time futurists, experts and researchers who explore all kind of future-related issues. Their purpose is especially not to analyse only the developments in their individual fields of expertise but to connect them to a bigger picture of the future.	Becker (2003), Neef and Daheim (2005), Daheim and Uertz (2006)
Outsourcer (can be *ad hoc*) ('episodic' foresight)	This type of OF 'unit' identifies and defines the subject area and goals of a foresight process from its expert perspective within the enterprise, but often lets the processes itself or larger parts of the research involved be conducted by an external organisation/consultancy/think tank before 're-integrating' and utilizing the results in strategic planning or other business fields within the enterprise. It can also be a temporary task force, set up on 'ad-hoc' basis and relying on external contribution.	Daheim and Uertz, 2008; Rohrbeck, 2009; Vecchiato and Ravena, 2010
Multi-client (participative, shared, open, but still 'episodic' foresight)	These studies are financed by several enterprises and/or by governmental bodies in order to cope with some very complex issues of common interest (e.g. the 'HyWays' consortium for promoting and developing a hydrogen infrastructure).	Vecchiato and Ravena, 2010
Embedded foresight	Foresight is embedded in other strategic activities in a corporate or a business department (e.g., R&D, marketing) usually by focusing on a specific field of investigation, and is carried out by a few people as one of their several tasks (explicit or implicit).	Vecchiato and Ravena, 2010; Rohrbeck, 2010

Source: compiled by the author, also based on Hines (2011)

The foresight unit is established either at the corporate or business level and may either focus on a specific field, such as science and technology for R&D planning, or a heterogeneous group of futurists, researchers and experts who deliver a more

comprehensive investigation of many different fields in the business micro- and macro environment. Becker (2003) distinguishes between an observatory, a collecting post or a think tank. Rohrbeck (2010) calls this a *structured approach*, in which dedicated units direct the foresight activities and foresight is linked to other organisational functions and processes.

Other firms have no foresight unit; foresight is rather *embedded* in other strategic activities in a corporate or a business department (e.g., R&D, marketing) by focusing on a specific field of investigation, carried out by a few people as one of their several tasks (explicit or implicit). Rohrbeck (2010) describes this as a *cultural approach*, which involves a much larger proportion of the organisation and makes individuals responsible and accountable through traditional processes such as new business development processes and corporate entrepreneurship (Hines, 2011).

Moreover, every study on the institutionalisation of organisational foresight is based on large, mostly multinational, companies, leaving small and medium sized enterprises (SMEs) aside. As noted by Neef and Daheim (2005), 'small and medium sized enterprises are a white spot in organisational foresight research'. The foresight needs and activities of SMEs have stayed below the radar, even though the value of SMEs' contribution to employment, value creation, and innovation is well recognised. Jannek and Burmeister (2008) state SMEs need foresight when they operate in highly competitive and dynamic markets. The more a company is willing to change, the more it depends on foresight knowledge to provide security for investment decisions. Jannek and Burmeister (2008) in their study also showed that SMEs do carry out organisational foresight activities. Eighty-five percent of the surveyed German SMEs regularly monitored developments in their markets and industries. Twenty-nine percent *frequently* and 61 percent *sometimes* scanned markets and industries they were not involved in. Seventy-four percent regularly monitored issues, trends and new technologies considered relevant for their business. Additionally, 30 percent often scanned their environments for new issues, trends and technologies whose relevance cannot yet be assessed (Jannek and Burmeister, 2008). According to the same study SMEs used various foresight methods for scanning, monitoring, analysis and idea transfer. Most frequently used were brainstorming, desk research, e.g. internet and media analysis, and expert interviews.

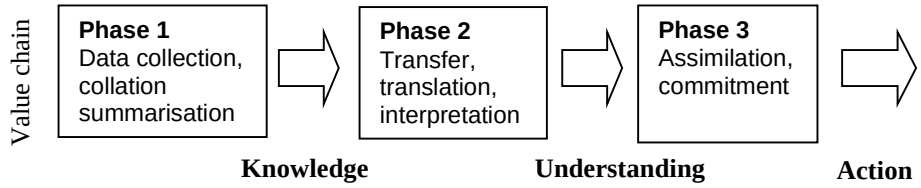
Past research provides important insights. Most importantly, the institutionalisation approaches based on having specific units are not applicable in the context of most companies, especially SMEs.

2.2.4. A process approach to organisational foresight

The process approach to organisational foresight makes a distinction between foresight's content and its process. It examines how foresight outcomes (e.g. innovation strategy) emerge rather than focusing on what decisions are taken. This approach mirrors the 'strategy as process' approach as opposed to 'strategy as content' streams in the strategic management research (discussed by e.g. Chia and McKay, 2007). One stream of process approach focuses on the above-described 'ad-hoc' or 'episodic' foresight and considers it as a process consisting of several steps. While early studies (e.g. Daft and Weick, 1984) proposed simple process models consisting of three steps (scanning, interpretation and learning), more current process models consist of six or seven process steps.

A valuable contribution from process-based models is viewing organisational foresight as a forward-looking knowledge management process. For example, Horton (1999) suggested that strategic foresight consists of three phases. *Phase one* comprises the collection, collation and summarisation of available future related information (e.g. trends, expected developments, brainstorming usual happenings, from experts, suppliers, customers, universities, networks and so on) and results in the production of what has been labelled foresight knowledge. *Phase two* comprises the translation, interpretation and exploitation of this knowledge to produce an understanding of its implication for the future, from the specific point of view of particular enterprise). This phase is considered to be the heart of the process. *Phase three* produces commitment to action. It has been argued that each phase creates a greater value than the previous one as the outputs move up the information value chain from information to knowledge and understanding. However, it has been contended that this value is only realised at the very end of the process and often with a significant time lag. Also, it is concluded that if the process is prosperous, it brings about decisions and actions different to those which would have been the case without the process (Horton, 1999; Amsteus, 2011). Viewing foresight process from an organisational learning perspective suggests that data collected has to be transferred, interpreted and exploited within a firm.

Figure 2. A foresight process



Source: adapted from Horton (1999) and Amsteus (2011)

The most comprehensive process model is proposed by Bishop *et al.* (2007) and later developed by Grim (2009) into the foresight maturity framework (Table 4).

Table 4. Process model proposed by Bishop et al. (2007)

Step	Description	Product
Framing	Scoping the project: attitudes, audience, work environment, rationale, purposes, objectives, and teams.	Project plan
Scanning	Collecting information: the system, history and context of the issue and how to scan the information regarding the future of the issue.	Information
Forecasting	Describing baseline and alternative futures: drivers and uncertainties, implications and outcomes.	Baseline and alternative futures (scenarios)
Visioning	Choosing a preferred future: envisioning the best outcomes, goal-setting, performance measures.	Preferred future (goals)
Planning	Organizing the resources: strategy, options, plans.	Strategic plan (strategies)
Acting	Implementing the plan: communicating the results, developing action agendas, and institutionalising strategic thinking and intelligence systems.	Action plan (initiatives)

Source: Hines et al. (2007)

An emerging stream of the process approach conceptualises foresight as something in flux and transformation. This perspective is underpinned by the premise that it is the basic strengths of everyday operations that drive strategy process and emergence (Whittington, 2002). It frequently problematizes the role of experts in facilitating organisational foresight. It draws extensively on strategy-as-practice theory and presents foresight as the situated organising activities and practices that transgress established boundaries to seize opportunities otherwise overlooked by competitors (e.g. Cunha, 2004, Sarpong et al., 2013). This perspective reorients organisational foresight research towards the day-to-day activities, micro-strategies, routines and competencies of individual managers and teams, rather than focusing on the core competence of the organisation as a whole. Hence, this stream focuses on

organisational practices and routines that constitute 'the internal life of process' (Tsoukas and Chia, 2002), and is based on evolutionary perspective.

2.2.5. Arguments for capability-based approach to organisational foresight

The literature illuminates many recommendations on how to manage discontinuous change by cultivating forward-looking methods and processes, especially by implementing project-based organisational foresight exercises carefully facilitated by external consultants. However, as noted by Rohrbeck (2010), the goal of identifying how an embedded and comprehensive future-oriented management system can be built has not been reached (Rohrbeck and Gemuenden, 2011). It is not only important to identify, anticipate and assess discontinuous change, but also to effectively *use* this information to plan and execute appropriate strategic response. Empirical research based on case studies and surveys confirm that, despite the perceived importance of strategic foresight (Daheim and Uertz, 2006; Schwarz, 2007, Rohrbeck, 2010) the implementation of effective institutionalised foresight systems is limited (e.g. Becker, 2002; Reger, 2001; Rohrbeck, 2010). Secondly, the results of episodic foresight exercises are usually not implemented in practice. Although sensing and anticipating are not particularly difficult, building an organisational structure that facilitates an effective response to change can be challenging (Rohrbeck, 2010). One possible explanation for this persistent gap between perceived importance and implementation could be the lack of applicable knowledge and the lack of organisational incentives and capabilities that would foster the usa of anticipatory information for generating effective responses (based on Rohrbeck et al, 2009; Rohrbeck, 2010).

Given the above considerations, this study takes a stance that instead of viewing organisational foresight as a clearly separated exercise outside the firm's day-to-day activities, it should be seen as a capability (or set of capabilities) *embedded* in the firm's strategic activities, thus involving a much larger proportion of the organisation and making individuals responsible and accountable for forward looking activities through traditional processes such as new business development processes and corporate entrepreneurship. Organisational foresight is therefore defined as *an ability that includes structural and cultural capabilities enabling the firm to detect discontinuous change early, interpret the consequences for the firm and formulate*

effective responses, while at the same maintaining a high-quality, coherent and functional forward view.

The capability-based approach to organisational foresight has been addressed by the Rohrbeck's (2010) organisational future orientation model. His study suggests that an organisational foresight capability can be built upon foresight unit that utilises foresight methods, but also includes the possibility that a firm builds its future orientation using other means, such as encouraging all employees to look for external change and empowering them to respond to this change with individual initiative. The future orientation model is constructed of different capabilities such as culture (e.g. willingness to share), organisation (e.g. integration of foresight activities within processes of innovation management or strategic management), method sophistication (e.g. integration capacity), information usage (e.g. sources and scope), and people and networks (especially the internal communication and the use of internal and external networks).

The approach to organisational foresight as a capability could be supported by the resource-based view (RBV) and the concept of dynamic capabilities (Teece, 1997). RBV builds on the central concept that the ability of an enterprise to compete successfully against rivals depends on certain (strategic) resources (Barney, 1991). The first to introduce this concept was Penrose, who explicitly stated the importance of certain resources for value creation. In order to provide a competitive advantage, the resource needs to have certain characteristics. The resource should be (1) valuable, i.e., yield a competitive advantage, (2) rare or scarce, (3) inimitable and (4) non-substitutable (Barney, 1991; Eisenhardt and Martin, 2000). Using such resources, enterprises can achieve sustainable competitive advantage by implementing value creating strategies that cannot be easily duplicated by competing enterprises (Barney, 1991). Rohrbeck (2010) argued that *organisational foresight capabilities are a resource in their own right*. An implemented organisational foresight system either as a process, method or capability allows the organisation to discover and exploit new business opportunities ahead of rivals that lack similar systems (Rohrbeck, 2010). It could be argued that its competitive advantage resides in the difficulty to implement organisational foresight in different corporate contexts, and it is especially hard to achieve for small and medium sized enterprises.

The *dynamic-capabilities* concept was introduced by Teece based on the criticism that RBV fails to explain how enterprises gain a competitive advantage in dynamic

markets, defined as the 'ability to integrate, build, and reconfigure internal and external competences to address rapidly changing environments' (Teece et al., 1997). Teece observed that in changing environmental conditions, like for example a technological disruption or wild card event, enterprises will have to adapt their portfolio of resources. Teece proposed that enterprises that are in a technological change or a similar situation need to have the inimitable capability 'to shape, reshape, configure, and reconfigure their resources so as to respond to changing technologies and markets'. A discontinuous change will challenge an enterprise to exercise its dynamic capabilities in order to change and acquire new resources that enhance its ability to compete (Danneels, 2008), or to replace capabilities that have become invaluable over time (Ambrosini and Bowman, 2009). In the view of organisational future orientation, Rohrbeck (2010) argued that organisational foresight (or its elements) should be expected to support the renewal of the portfolio of strategic organisational resources when faced with rapid external change. Organisational foresight thus can be regarded as a dynamic *capability* that enables an enterprise to detect a need to renew its portfolio of resources (Rohrbeck, 2010) and thus it can contribute to innovation.

2.2.6. Proposed conceptual framework: an integrative perspective

The sub-chapters above reviewed the extant literature on organisational foresight and defined the gaps in the dominant approaches. Given the discussed limitations and following the definition proposed in the previous sub-chapter, this study argues for an integrative approach to organisational foresight as an everyday organisational practice, where foresight methods, processes and competences are not mutually exclusive - a process can contain a series of methods, and methods and processes can be used to achieve a capability. Capabilities are a collection of high-level, learned, patterned, repetitious behaviours that an organisation can perform better relative to its competition (Nelson and Winter, 1982; Winter, 2003). A capability model tends to measure organisational attributes rather than individual attributes. So it is more suitable (in contrast to competences or behaviour based models) for the purposes of this study which takes the perspective of an organisation as a whole. Behaviour only focuses on the existing operational activity that an organisation or its employees are performing, while firm-wide capabilities describe the whole range of repeated behaviours (routines) evolving over time. Capability focuses on the current and also potential behaviours that an organisation may be able to perform.

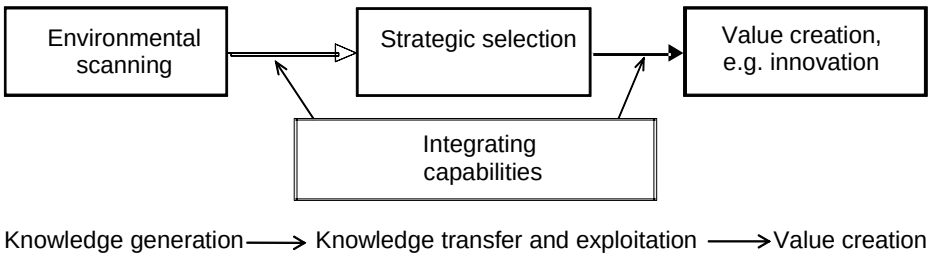
Hence, organisational foresight is presented as an ability that enables organisations to deal with uncertainty in their everyday activities. This ability provides means for the creation, exploration and exploitation of long-term competitive advantage in fast-moving environments characterised by great uncertainty. The capability-based conceptualisation of organisational foresight inverts and challenges existing management and practitioners' conventional understanding of foresight as a strictly methods-based, institutionalised, or one-off activity that is in waiting to be facilitated by experts with specific end points and conformity. From this perspective, organisational foresight will have to be viewed as a crucial organisational practice that takes place at the micro-level, a shift 'from a technical–rationalistic episodic activity to a socially embedded process-based and permanent competence' (Cunha *et al*., 2006).

There is little operationalisation and a lack of empirical grounding concerning the concept of organisational foresight as a capability. To address this issue, this sub-chapter aims at conceptualising and operationalising the construct further in order to enable its empirical analysis. *First*, organisational foresight is regarded as an environmental 'future-related' information gathering process based on scanning the external environment by using different sources and techniques. The types of issues mapped by such a 'horizon scan' can include emerging trends, policies, products, services, markets, stakeholders or consumers, technologies, practices, behaviours, attitudes, 'surprises' (wild cards) and 'seeds of change' (weak signals). *Second*, an important conclusion from the literature review is that organisational foresight process can be explained from the perspective of organisational learning theories. Every tangible and intangible (i.e., product and process) output reflects the enterprise's knowledge of its resources, technologies, markets, and consumers (Stone et al, 2009). Organisational learning is defined as a set of capabilities aimed at collecting, adding value to and using effectively the internal and external knowledge gained by the enterprise (Thérin and Dalglish, 2004). Hence, from the stage when new insights and weak signals are identified by horizon/environmental scanning system and then transferred to organisation, decoded, used and disseminated, certain organisational capabilities are required for successful selection, transfer and usage (exploitation) of the generated insights. *Third*, scanning the environment is not the only role of foresight. Foresight has several roles – one of them is shaping the future through participatory techniques aimed at achieving consensus on the vision or strategy. Hence, it is also a reflection and knowledge-generating process and a vision-building and direction-

setting process (Daheim and Uertz, 2006). *Fourth*, value is created, when foresight insights are turned into action and output, such as enhanced reaction to opportunities and threats, reduced uncertainty and successful innovations (Rohrbeck, 2010).

To enhance the maturity of organisational foresight research and to move closer to theory development, a unifying framework with its constituting elements is needed. Such a framework can be an important step for developing testable constructs and hypotheses and thus lead the transition to deductive research. A formative second-order (or higher level) conceptual framework is proposed. This framework takes into account key elements of foresight (methods, process steps and enabling organisational traits such as organisational culture) tying the different approaches together. The preliminary framework is depicted by Figure 3. It focuses on three groups of higher-order capabilities at the most comprehensive analytical level: (i) environmental scanning, (ii) strategic selection and (iii) integrating capabilities. Second-order model is suggested as strategic foresight capabilities reside at a higher level of abstraction than their underlying processes or activities.

Figure 3. Second order conceptual framework



Environmental scanning refers to the activity of learning events and trends in the organisation's environment and which facilitates market and technological opportunity recognition (Danneels, 2008). Strategic selection refers to the organisational activities involved in identifying a preferred alternative for organisational change (Zott, 2003). Integrating refers to the organisational strategy, climate and infrastructure for integrating resources to create and capture value from opportunities – Teece also calls it 'seizing' (Teece, 2007). The existence of these higher level capabilities cannot be assumed without specifying the particular routines that are crucial for their development and deployment in practice. The sections below provide arguments for conceptualising the lower level capabilities (routines, traits).

Environmental scanning capabilities

Competitive and technological uncertainties make it difficult to determine which external resources are most likely to support innovative products that are relevant for existing or emerging markets (Teece et al, 1997), therefore companies need external / *environmental scanning capabilities* for recognising valuable sources of external knowledge. External scanning processes enable companies to identify and recognise new and emerging markets and technologies (Danneels, 2008). Such intelligence drives the ability to sense opportunities for innovation. Environment scanning is a sub-component of strategic foresight that has been studied most frequently (e.g. by Ansoff, 1980; Becker, 2002; Daheim and Uertz, 2006; Danneels, 2008; Jain, 1984; Janek and Burmeister, 2008; Daft et al., 1988; Rohrbeck, 2008, 2010). One of its specific features is **time horizon** described as the time scale of environmental scanning focused on different horizons – from short term (up to one year) to long term (up to 30-50 years in the future). Most scholars report organisational foresight having a role mainly in the long- and medium-term. For instance, in the managerial foresight scale proposed by Amsteus (2011), managers are asked to take into account future conditions, plans and objectives that are at least 2 years in the future. However others emphasize the importance of foresight for the short-term planning, because the scanning system has inherent blind spots and foresight is needed to regularly scan these areas (e.g. Day and Schoemaker, 2005). This study takes the stance that environmental scanning should play a role in all time horizons of strategic planning. Rohrbeck *et al* (2009) suggested that scanning for different time horizons creates the possibility for firms to detect changes at different stages of their development, which facilitates building comprehensive strategies to react to them. According to multiple cases by Rohrbeck (2010) on multinational companies, companies reported having different strategic planning (and therefore scanning) processes for different time horizons:

- A short-term planning process, which plans the next fiscal year and includes a small amount of strategic planning. It has more the character of identifying top level goals and short-term opportunities. But particularly the discussion between the business units and the corporate level was described as a strategic planning process.
- A medium-term planning process, which plans 3–5 years ahead and is focused on evaluating current markets. The result is often a strategic plan which shifts emphasis from one business field to another.

- A long-term planning process, which looks 15–25 years ahead, plans the road toward future markets, and proposes measures to deal with potential disruptions.

Another important element is **depth of scanning** described as a wide scope of environmental scanning, including the areas that currently seem to have no relevance to the company but which could breed disruptive changes that are difficult to perceive and to prepare for. Depth is characterized by how deep (at how many different levels) a firm scans and what kind of information that is gathered and fed into an organisational foresight process. For example, Reger (2001) and Rohrbeck (2010) differentiates current business, adjacent business, and white spaces, the latter being areas that currently seem to have no relevance to the firm but which could breed disruptive changes that are difficult to perceive and to prepare for. Many scholars also describe depth (sometimes called scope) as political, technological, consumer, and competitive environment segments (e.g. Becker, 2002; Jain, 1984; Rohrbeck, 2010).

Companies need to consciously choose appropriate external sources of information. For example, Lichtenthaler (2002, cf Rohrbeck 2010) suggested that companies operating in high clock-speed environments cannot rely entirely on the usual sources of information on technological change, such as patent data, because of the time lag of approximately 18 months between the initial discovery and the publication of the patent. Companies in high clock-speed industries should therefore rely more on information gathering through personal networks or research collaborations with industry partners and research institutes. One of the main benefits of these collaborations is access to information on market demand and innovation. Being better linked is related to increased innovation performance (Fleming et al., 2007; Hochberg et al., 2007; Schilling and Phelps, 2007; Rothwell, 1991; Fukugawa, 2006). Exploitation of external sources is also stressed by Battistella and Toni (2010), and by Jannek and Burmeister (2008) who claimed that collaboration between enterprises and external stakeholders (e.g. governmental studies, industrial associations, chambers of commerce, or technology platforms) can be used to improve smaller companies' foresight activities and generate economies of scale.

This study differentiates external sources by **weak tie and strong tie sources**. This classification has roots in the Granovetter's (1983) weak ties sociological theory, which proposed that weak rather than strong ties are appropriate for access to new knowledge. Granovetter linked strong (weak) ties to a dense (sparse) structure. In frequent and intense interaction between many actors, in a dense structure, much of

the information circulating in the system is redundant. *Strong tie sources* describe exploiting sources of information with which companies typically have many social acquaintances in their everyday work (e.g. suppliers, customers). *Weak tie sources* are described as external sources of information with which the companies typically have little contact, but they can nevertheless provide conceptually new information. Among weak tie sources, some are related more specifically to new technologies. Such sources are located principally in research and educational communities, composed mainly of research centres and universities, scientific advisors and other related public organisations (Smeltzer et al. 1991; Julien *et al*, 2004). Battistella and Toni (2010) in their multi-case organisational foresight study divided the external networks into different sub-networks: events, industry initiatives, relationships with other actors of the supply chain, collaboration for standards, relationships with other enterprises for foresight projects, open innovation initiatives (blogs, etc.), customers involvement and collaboration labs, partnerships with universities and research centres. Generally speaking, such weak tie sources (networks) are particularly important in that they help entrepreneurs think beyond what is known and spot new opportunities. Ansoff (1980) argued that, in such a case, although the signals may be ambiguous, fragmentary or uncertain, they can nevertheless be anticipatory in that they call existing knowledge into question or add new elements leading to innovation. According to Battistella and Toni (2010), it is opportune to nurture every external sub-network in order to have more and different sources of information.

Using the external sources typically requires foresight *methods*, such as (Becker, 2002; Daheim and Uertz, 2006; Jannek and Burmeister, 2008; Rohrbeck et al, 2009; Rohrbeck, 2010): trend analysis; media and publication analysis; patent and technology analysis; involvement of experts, e.g. Delphi surveys, expert interviews, expert panels.

In summary, environmental scanning in this study is defined as the extent to which a company deploys strong and weak tie external sources of information covering a stretch of time horizon from near to long term future, which facilitates market and technological opportunity recognition.

Strategic selection capabilities

Environmental scanning can generate a lot of new data but the tricky part is to select the knowledge that is valuable, to figure out implications for action and select a

preferred scenario of the future. When new opportunities are first identified, companies need to gather and filter technological, market, and competitive information to figure out implications for action (Cepeda and Vera, 2007). For that, firms need to conduct strategic selection processes (Capron and Mitchell, 2009). Firstly, firms need to analyse external knowledge. Many of the organisational foresight studies suggest that **analysis** of the accessed information is a key element in organisational foresight processes. For example, the managerial foresight scale by Amsteus (2011) takes into account what part of the facts on the past, potential future conditions, plans and targets are analysed by managers. As suggested by Grim (2009) it also helps considering the widest possible set of plausible alternatives in evaluating choices or decisions affecting the system. While analysing is useful for generating alternative futures, visioning and planning are necessary for selecting the preferred future and feeding it into the strategic and activity planning. **Visioning** helps creating a preferred future that imaginatively captures organisation's values and articulates the unique contribution that frames the organisation's view moving forward. This capability is linked to a systematic visioning process and specific methods that help communicating the long term aspirations and creating an agreement on organisation's vision throughout the organisation (Bishop *et al*, 2007; Grim, 2009). **Planning** is strategic in ensuring that people, skills, and processes support the vision. There is a plethora of organisational routines which are deployed to ensure good planning, from strategic and activity plans to rigorous measurement of business performance against goals and objectives. In summary, the quality of planning helps moving from visioning to acting.

Therefore, strategic selection capabilities are described as organisational routines driven by analysing, visioning and planning, all determined to identify and sustain the preferred alternative for organisational change. Foresight methods often suggested for strategic selection are scenarios help increasing the communication capacity of foresight results (Rohrbeck, 2010). Communication capacity can be achieved with participation in the method, as is the case for example in roadmapping (Phaal et al., 2004), and by producing results that can easily be communicated, as is the case with the scenario technique, which produces an alternative future that is transparent and easy to understand by outsiders and thus easy to communicate (Mietzner and Reger, 2005; Van der Heijden, 2005). The communication capacity plays a particularly important role in high clock-speed industries, because the time for interpretation of weak signals is shorter and responding quickly will be possible only if

the insights have been created with the participation of relevant stakeholders from multiple perspectives (Rohrbeck, 2010). When an organisation intentionally applies these methods, one can expect that strategic foresight is embedded in its strategic management processes.

Integrating capabilities

Once external knowledge is identified and selected, the integrating capabilities play an important role in diffusing, replicating, and maintaining this knowledge within the organisation (Cepeda and Vera, 2007). Integrating capabilities are thus important enablers of foresight success. Literature associates integrating capabilities with internal organisational culture and the human component, which can to some extent act as a substitute for formal foresight processes. Several authors in their empirical studies suggested that cultural barriers are blocking the implementation of foresight results. For example, Rohrbeck (2009, 2010) listed the lack of top management using future insights and lack of inclination/motivation to think about the future; lack of incentive to think about the future, reward and career system that is ignorant to foresight; limited attention of internal stakeholders and current controlling systems. He also argued that if an enterprise manages to encourage its employees to be open to external information and to diffuse it effectively throughout the whole organisation, then it can be expected that this will support strongly its ability to retain a competitive advantage in times of discontinuous change (Rohrbeck, 2010). Day and Schoemaker (2005) noted that the lack of willingness to share across functions is often the most important obstacle blocking the dissemination of foresight insights.

A study by Vecchiato and Ravena (2010) suggests that for developing an effective response to change managers have to change their mental models. The cornerstone of this research is the bounded rationality of managers, according to which their capability of making perfectly rational decisions is limited by the knowledge about issues, opportunities and events in their business environment they can actually absorb, process and disseminate. Indeed, mental models may encourage stereotypic thinking and inhibit creative problem solving (Vecchiato and Ravena, 2010). Before them, Day and Schoemaker (2005) proposed that the 'peripheral vision' of managers could be enhanced by their readiness to listen to scouts and external sources (as most insights have sources outside the enterprise), and their willingness to test and challenge basic assumptions (Day and Schoemaker, 2005; also applied by Rohrbeck,

2010). Blackman and Henderson point out the importance of double-loop doubting for foresight. They emphasise that it is important not only to challenge basic assumptions but also to challenge the underlying mental models that are used to build consistent expectations about the future (Blackman and Henderson, 2004).

The innovation studies that have tried to resolve the innovator's dilemma (Christensen, 1997; Papadakis and Bourantas, 1998; Lefebvre and Lefebvre, 1992; Hegarty and Hoffman, 1990) how to cope with the necessity of development around a core of technologies and at the same time always renew the enterprise's activities point out the managers' role. Employee resistance and conflicts regarding how to obtain and assemble resources can be overcome by effective leadership - corporate values, effective communication, and reward systems help determining the channels and types of knowledge that are tolerated and encouraged (e.g. Rohrbeck, 2010). Rohrbeck (2010) and Day and Schoemaker (2005) emphasize the leadership's role and commitment in facilitating the forward-looking culture and encouraging peripheral vision by providing incentives (rewards or bonuses) to reward wider vision, communicating meaning and values, and allocating the necessary resources. **Leadership** thus refers to the degree to which senior management fosters the organisational culture open to wider vision. Top management commitment increases the chances of embedding strategic foresight, higher visibility and relevance of forward-looking, an easier implementation of results and recommendations (Day and Schoemaker, 2005; Rohrbeck, 2010). Literature on organisational learning suggests that certain manager's characteristics, such as vision and communication of meaning, as well as openness to new ideas and constructive discussion create surrounding atmosphere conducive to organisational learning and absorptive capacity, which encompasses a set of organisational processes aimed at maximising the added value of externally acquired knowledge. The concept of absorptive capacity was defined by Cohen and Levinthal (1990) as the ability of an organisation to recognise the value of new, external information, assimilate it, and apply it to commercial ends. Tsai (2001) tested and confirmed the relationship between absorptive capacity and innovation. If the manager is learning oriented and shares his/her vision with all the employees, absorptive capacity should be higher. Absorptive capacity is embedded within the shared social context of units (Tsai, 2001). Socialisation capabilities emerge from such a leadership context and produce a shared ideology. They specify tacitly understood rules and lead to the development of a network of linkages within units. The relational

density of such a network serves as a governance mechanism and facilitates the exchange of information and knowledge (Jaworski and Kohli, 1993; Tsai, 2001). Moreover, it leads to established norms of cooperative behaviour (Walker, Kogut and Shan, 1997).

Effective incorporation of new knowledge requires effective **coordination** processes. Coordination is defined as the capacity of formal and informal communication, which describes the role and effectiveness of communication in the diffusion of information and future insights (based on Rohrbeck, 2010). Coordination processes have been shown to enhance the speed and efficiency of resource transfer (Verona and Ravasi, 2003). Rohrbeck (2010) observed informal communication capacity in firms with weaknesses in formalised processes but with a good track record of surviving and succeeding in times of discontinuous change. He suggested that in an organisation with high coordination capabilities, every employee is expected to build and maintain formal and informal networks to other units, and information is shared freely across functions and hierarchical levels, activities of different departments are well coordinated. To respond to discontinuous change it is important to foster linkages between units responsible for developing new products and units (as well external networks) with complementary assets needed to commercialise the innovation. A similar phenomenon has been investigated in innovation-management research. It has been shown that groups that work together for a long time continuously decrease their communication and collaboration with external colleagues (Katz and Allen, 1982). Enterprises that have a long track record of working in an isolated fashion should therefore be alert to this threat and work on ways to encourage the building and maintaining of external networks.

Organisational learning theories also support effective coordination by saying that absorptive capacity requires routines and capabilities for integrating and exploiting new knowledge. It implies development and internalisation of effective routines for transferring knowledge across and within sub-units; exchanging and sharing knowledge; appropriating knowledge from spill-overs; and safeguarding crucial internal knowledge from imitation. That is, absorptive capacity also depends on internal mechanisms or organisational antecedents (Cohen and Levinthal, 1990; Lane and Lubatkin, 1998; Van den Bosch et al., 1999). Examples of these internal mechanisms are structure of communication, character and distribution of expertise, cross-functional interfaces and job-rotation (Cohen and Levinthal, 1990).

The recognition, articulation and codification of valuable foresight knowledge is subject to the knowledge previously acquired at the firm, therefore giving this process an accumulative (path dependency) character. Cohen and Levinthal (1990) suggested that success of scanning and strategic selection is thus influenced by the stock of knowledge accumulated within the firm, embodied by skilled human resources and accrued through in-house learning efforts - its **prior knowledge base**. In-house R&D activities and highly educated personnel are often perceived as the most effective ways to absorb external knowledge, thus, are often used as a measure of knowledge base (e.g. Oerlemans and Meeus, 2005). However, we note that few companies, especially small- and medium-sized ones operating in traditional industries, have a separate R&D department or formally trained researchers. Skills are usually developed through job training and practical experience. That means the longer employees work the more skills they obtain. Therefore, experience could be included as a valuable trait of knowledge base as it represents the cognitive background of each of the abovementioned resources in temporal terms. For example, Guliani and Bell (2005) measure knowledge accumulated within an enterprise as a the number of technically qualified personnel in the enterprise and their level of education and training, the experience of professional staff - in terms of time in the industry and the number of other enterprises in which they had been employed, and the intensity and nature of the enterprises' experimentation activities - an appropriate proxy for knowledge creation efforts (Giuliani and Bell, 2005).

We draw on the literature on absorptive capacity (Table 5) and claim that firms will assimilate knowledge depending on: a) the amount of knowledge they have accumulated over time; b) their capacity to decode and absorb knowledge. This capacity can be enhanced by (Jansen et al, 2003) coordination and leadership capabilities of top management. Given the above, this study defines integrating capabilities as the organisational leadership and coordination capabilities as well as the existing knowledge base, required to create and capture value from opportunities. These capabilities are critical for creating organisational culture which promotes trust, openness, encourages vertical and horizontal communication, essential in supporting natural information gathering and rapid insight diffusion.

Table 5. What organisational traits enhance knowledge transfer and absorption?

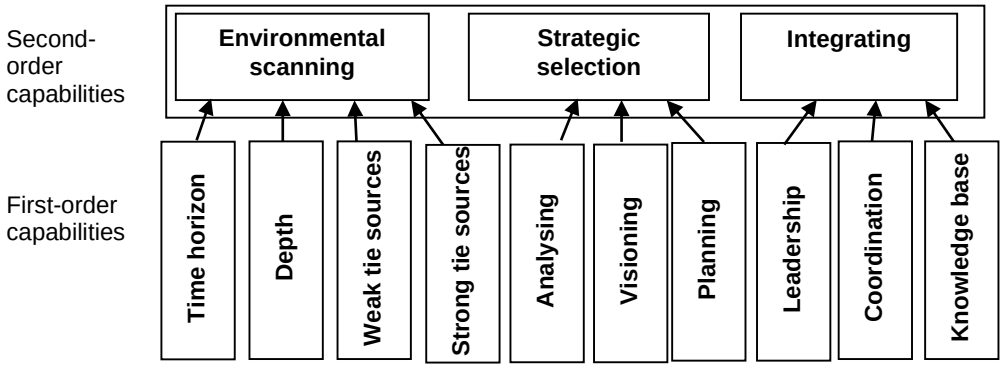
Group	Attribute	Source
Coordination	Sharing across functions, level of connectedness, informal communication	Cohen and Levinthal, 1990, 1993; Gupta and Govindarajan, 2000; Nahapiet and Ghoshal, 1998; Rowleyet al., 2000; Tsai, 2002; Jansen et al., 2003; Zahra and George, 2002
Leadership	Leadership attributes in terms of vision and communicating meaning	Thérin and Dalglish, 2004
Prior knowledge accumulated	Number of technically qualified personnel in the enterprise	Giuliani and Bell, 2005; Julien et al. 2004
	Their level of education and training	Giuliani and Bell, 2005; Julien et al. (2004)
	The experience of professional staff	Giuliani and Bell, 2005; Julien et al (2004)
	The intensity of the enterprises' experimentation activities	Giuliani and Bell, 2005

Source: compiled by author

A unifying framework

Drawing on literature, the specific underlying sub-components were identified that put organisational foresight into use. Figure 4 delineates how these sub-components apply to organisational foresight and how they enable higher-level environmental scanning, strategic selection and integrating capabilities. These capabilities may not exhaust all factors that enable the specified second-order capabilities, but they are posited as representative of existing literature.

Figure 4. Conceptualisation of organisational foresight capabilities



Source: depicted by author

Having identified the key elements that explain the concept of organisational foresight, the final step is to propose a testable model in order to enable the empirical analysis**.** But firstly, the arguments for the link between organisational foresight and ambidexterity are provided in the next Chapter. The final model for empirical research is discussed in Chapter 3.

2.3. ORGANISATIONAL AMBIDEXTERITY

The Roman god Janus had two sets of eyes - one pair focusing on what lay behind, the other on what lay ahead. Corporate executives too must constantly look backward, attending to the products and processes of the past, while also gazing forward, preparing for the innovations that will define the future. Charles A. O'Reilly and Michael L. Tushman

Organisational foresight and its relationship to explorative and exploitative innovation (organisational ambidexterity) is the focal point of this dissertation. The main research question is if and which foresight capabilities contribute to ambidexterity. When striving for ambidexterity it is important to understand relations to both exploration and exploitation. This chapter confronts and discusses various conceptual and empirical attempts to link organisational foresight and innovation. Firstly, the concepts and typologies of innovation are discussed. Further, an introduction to the concept of organisational ambidexterity is provided. Thirdly, the link between organisational foresight and ambidextrous innovation is described. Finally, a Chapter summary is provided.

2.3.1. Innovation: types and measurement

Unland and Kleiner (1996) claim that the environment is continuously changing and evolving; hence businesses must change too or lose competitiveness. Certainly, enterprises do change or innovate in terms of business models, products, services, and processes (Xu et al., 2007). Innovation is considered to be of 'paramount importance' for companies due to the quickly changing technologies and environments, shorter product-life-cycles and an increasing difficulty to differentiate from competitors. As a consequence, the management of innovation, in order to systematically generate new ideas and to develop them into marketable goods and services, has become a key competitive factor in today's business environments (Gracht, 2010), and innovations are considered vital to enterprise competitiveness and performance (Garcia, 1998; Hansen, 2006; Nobelius, 2004).

The current version of the Oslo Manual (2005) defines four types of innovation: product innovation, process innovation, marketing innovation and organisational innovation. Product innovation is defined as a good or service that is new or

significantly improved. This includes significant improvements in technical specifications, components and materials, software in the product, user friendliness or other functional characteristics. Process innovation is a new or significantly improved production or delivery method. This includes significant changes in techniques, equipment and/or software. Marketing innovation is a new marketing method involving significant changes in product design or packaging, product placement, product promotion or pricing. And finally, organisational innovation is a new organisational method in business practices, workplace organisation or external relations.

Product innovation typologies include *incremental* and *radical* innovations (Henderson and Clark, 1990; Tornatzky and Fleischer, 1990), *continuous* and *discontinuous* (Basalla, 1988), *competence-enhancing* and *competence-destroying* (Tushman and Anderson, 1986), *sustaining* and *disruptive* (Christensen, 1997; Christensen and Rosenbloom, 1995), as well as *open innovation* (Chesbrough, 2003), *technology or R&D based* and *non-technological* innovation. A common distinction usually made in the literature on innovation is between radical and incremental innovations, depending on the breadth and depth of the changes introduced. Colarelli O'Connor (2005) views *radical innovation* as the ability of an organisation to commercialise products and technologies that have a) high impact on the market in terms of offering wholly new benefits, and b) high impact on the firm in terms of their ability to spawn hole new lines of business. A fundamental characteristic of this class of innovations is their ability to change existing technological trajectories. Dahlin and Behrens (2005) developed and operationalised a definition for radical invention or innovation. For them a radical innovation needs to be: novel (that is the innovation needs to be dissimilar from prior innovations); unique (the innovation needs to be dissimilar from current innovations); adopted (it should have the power to influence future innovations). Scholars have often argued such innovations can easily alter industry structures, the metrics of competition and sometimes the economy as a whole (Anderson and Tushman, 1990; Trispas and Gavetti, 2000; Foster, 1986).

Incremental innovations are typically viewed as modifications of the existing products and/or processes. Measurement of incremental innovations can fall within several broad categories: (1) procedural, e.g. innovations in rules, work procedures, work schedules, etc.; (2) personnel, e.g. innovations in human resource management; creative changes in selection and training policies, etc.; (3) process, e.g. new methods of production or manufacturing processes or significant technology enhancements in

the organisation's operations that are used to produce a product or render a service; and (4) structural modifications, e.g. new innovations or creative modifications to equipment and facilities; innovative redesign of departments, divisions, and/or projects, etc. It can be a small change or a reconfiguration of an established system to link together existing components in a new way (Henderson and Clark, 1990).

Zaltman, Duncan and Holbeck (1973) discuss innovation as the process of developing the new item, innovation as the new item itself, and innovation as the process of adopting the new item. The new item can be specified by discussing product categories and degrees of newness. There is a distinction between goods and services and between the different aspects of the product, e.g. benefits, features, design, technology, services, quality, packaging, and/ or customer needs (Verhees, 2005). Whether a product is considered to be an innovation depends on whether it is perceived as new by an individual or other unit of adoption (Rogers, 1995). However, it should be clear whose perspective on newness is considered - the customer, the enterprise (the producer), the market, the scientific community, the industry, or the world. Booz, Allen and Hamilton (1982) score new products on a 'new-to-the-enterprise' dimension and on a 'new-to-the-market' dimension. Their framework introduces the problem of assessing the degree of product newness. One element of product newness is the width of its impact (ranging from worldwide, industry-wide, market-wide, and enterprise-wide to new to the customer). Another element is its impact on behaviours and required marketing and technological skills – new products require new skills. Most studies take the enterprise's perspective - most of the empirical management literature considers a product as an innovation if the producer of the product perceives it as new (Garcia and Calantone 2002). One common procedure is to ask managers to select new product projects (e.g. Gemuenden et al. 1996; Moorman and Miner 1997; Verhees, 2005).

From the reviewed academic and applied research it appears that there exist two leading methods of measuring innovation. First one is *innovation surveys*. This method gathers its information regarding technological innovation in products or processes directly from enterprise managers, usually through a survey. It covers the innovative behaviour and activities of the enterprise as a whole and explores the factors influencing the innovative behaviour of the enterprise, the scope of various innovation activities and the effects of innovations (Flor and Oltra, 2004). Thus, first-hand information can be obtained in order to value the innovations directly. The innovation

survey method suffers from two major shortcomings. It relies on indirect identification of innovation outputs through self-reporting by enterprises. Reliability and judgement are dependent on the respondent. The survey results are anonymous, and reported innovations lack details of their origin, nature and time of market entry, and thus limit the interpretations that can be drawn.

Another method collects data on innovation *from sales of new products*. This indicator is based on an enterprise's assessment in a postal survey of new product introductions (Kleinknecht et al, 2002). The outputs of innovative activities can vary along a number of dimensions, such as product-process-service, enterprise size, technical complexity and performance (Calvert et al, 2002). The category of 'new' products can include not only products or systems that include new technologies, but also include innovations that consist of a creative application of already existing technology (Kleinknecht et al, 2002). This measurement can directly indicate the extent of the success of innovation, by measuring innovative products that are introduced into the market. From this method, multivariate models are built to estimate the output resulted from R&D input. This can say something about the more or less efficient use of R&D inputs and about factors that influence that relationship. Another advantage is that, as far as large enterprises respond to innovation surveys at a more voluntary level, regional desegregation of output indicators can be done more easily than in the case of R&D figures (Kleinknecht et al, 2002).

A number of weaknesses of the latter approach may be identified. A low response rate is one of them. According to a study done by Kleinknecht et al (2002), another weakness is that many enterprises can give only 'rough estimates' of the share in sales of innovative products as well as lack of systematic and accurate statistics. Moreover, figures on shares in sales of innovative products may be sensitive to the business cycle (which may be misleading in some circumstances), and inter-sectoral technology flows are hard to assess with this indicator (Kleinknecht et al, 2002). They lack, therefore, some of the positive attributes of the direct measurement of innovation output events through sources external to the innovating organisation with publicly available, specific information on the source, attributes, and timing of innovation.

Literature suggests that the measurement of innovation performance varies widely according to how innovation is defined. Below are the main groups of innovation attributes, grouped along the new product development process, which starts with (a) product innovation initiation (idea generation, idea evaluation and go - no go decision),

continues to (b) innovation implementation (prototype development and testing, manufacturing and launching) and ends in (c) new product survival and success and innovation performance outcomes (based on Verhees, 2005; Zaltman et al., 1973):

- **Idea submission and flow**. The ideas flowing through an idea management system provide a visible reference point to the volume and quality of submissions. Proctor and Gamble uses an organisational capability input metric focused on 'the percentage of external sourcing of ideas and technology' as a way to drive its strategy for open innovation. The metric appears to be driving strategy: in 2006, half of all ideas and technology came from the outside (Palmer and Kaplan, 2007).
- **Product and/or technology innovation development** can be measured along the number of parameters (see Table 6 below). An interim product of innovation launch is patent submission - a popular approach that is however widely abused by many enterprises outside of the high technology and pharmaceutical industries. Patents are only one form of protectable intellectual property and many enterprises focus more on the legal aspects of protection than the business upside.
- **Innovation performance metrics** include return on innovation investment (ROI2 or R2I), new product success rate, new product survival rate, cumulative new product revenue and cumulative new product profit, growth impact, innovation revenues per employee. Most widely used parameter is therefore revenue growth from new products. Radjou (2004) revealed from a survey of 20 manufacturing enterprises worldwide in which 70 percent of the enterprises used 'revenue from new products' to measure the success rate of their innovations. Another 60 percent used 'profits from new products'; 50 percent used 'gains in market share'; 35 percent used 'time-to-market'; 25 percent used 'number of patents filed', while 10 percent used 'conversion rate of patents into products' to measure the success of their innovations.
- **Innovation capacity / intensity / innovativeness indexes**. According to Turrell (2004), leading enterprises are able to realise that a single metric, such as revenue growth or idea submission, is a poor indicator of innovation performance, and are developing 'innovation index', which combine a series of metrics to provide a more balanced view of innovation. Sometimes these indexes also include data whether the enterprise has become more innovative, using the parameters such as the R&D innovation emphasis ratio and innovation-portfolio mix.

A critical look at innovation literature provides a long list of innovation parameters that are presented in a Table 6 below.

Table 6. Product innovation attributes

Stage	Attribute / parameter	Source
Stage 1: idea generation and flow, including idea evaluation and go - no go decision	Increased number of new ideas. Improved quality of ideas. Number of ideas in the 'idea gathering' system. Number of new ideas implemented.	Morris (2008)
	Percent of ideas and technologies from outside	Morris (2008), Palmer and Kaplan (2007)
	Process-pipeline flow	Kuczmarski (2000)
Stage 2: Product / technology innovation launch, including interim products (e.g. patent generation)	The product technology is new to the customer	Ali et al. (1995)
	Improvements/revisions to existing enterprise products	Cooper and de Brentani (1991); Lugones (2009)
	Product technological newness to the enterprise	Green et. al. (1995)
	Degree of difference for other products in technical characteristics or specifications	Lee and Na (1994)
	Number of new product launches	Morris (2008); Stone et al (2009); CIS (2008); BCG (2003); Lugones (2009), McKinsey (2008)
	A new or decisively changed product, with a completely new function or functions. A new or decisively changed product with a different technology, but with the product having the same functionality as before.	Kleinknecht (1993), Coombs et al (1996)
	Modification of technology currently in use at the enterprise. Modification of technology used in other industries.	Colarelli O'Connor (1998)
	Newness of the technology: how large is required technology change in order to develop the product	Goldenberg, Lehman, and Mazursky (1999)
	Complexity of manufacturing technology	More (1982)
	Innovation incorporates a substantially different core technology relative to the previous product generation	Chandy and Tellis (2000)
	Number of patents applied for. Number of patents granted.	Morris (2008); CIS (2008)
Stage 3: innovation performance (outcomes), including interim stage (new product survival)	New product success rate. New product survival rate.	Kuczmarski (2000)
	Gross sales revenue; revenue growth due to new products or services in a given time period.	Morris (2008); Kuczmarski (2000)
	Number of new customers; percentage of new customers from new products / services	Morris (2008)
	Customer satisfaction with new products or services.	Morris (2008); BCG (2003)
	Percent of sales from new products / services in a given time period. Share of sales from patent protected innovation.	Morris (2008); Stone et al (2009); Kuczmarski (2000); BCG (2003); CIS (2008)
	Profit growth due to new products or services.	Morris, 2008; Stone et al. (2009)
	Return on investment (ROI) in new products or services. Changes in market share resulting from new products and services.	Stone et al (2009)
Enterprise innovativeness	R&D innovation emphasis ratio. Innovation-portfolio mix (percent of new products in the products portfolio). Innovation revenues per employee.	Kuczmarski (2000)

Source: compiled by the author

2.3.2. Ambidexterity and its conceptual relation to foresight

Conceptualising organisational learning capability along dimensions such as experimentation, risk taking, interaction with the external environment and participative decision making, Alegre and Chiva (2007) found that innovation performance is a function of organisational learning capability. In contrast with the neo-classical conception, which generally associates innovation with formal R&D activities, evolutionary economics specifically stresses the importance of learning processes. Various authors have refined not only the concept of learning by doing, but have constructed increasingly comprehensive classifications of the different learning processes. In the former, the essential thing is to understand that organisational learning processes are never automatic, but require specific investment of resources of varying quality and amount depending on the case. Similarly, enterprises learn in different ways, each leading to improvements in the stock of knowledge and specific technological capacities of the enterprises, which in turn generates a range of paths for technological progress and not a mere reduction in average costs. In turn, the different types of learning open up different directions for incremental technical change (Malerba, 1992). So, technological change at the level of the enterprise should be conceived as a continuous process of knowledge absorption or creation, determined in part by external inputs and in part by the past accumulation of skills and knowledge (Bell and Pavitt, 1993).

In the context of organisational learning, the distinction between exploration and exploitation has been made to describe two distinct types of innovation (March, 1991). Exploration is captured by the terms of search, risk taking and discovery and refers to radical innovations that are designed to meet the needs of emerging customers and markets (Danneels, 2002). It departs from established systems of production, and opens up new linkages to markets and users, offers new designs, and develops new channels of distribution (Abernathy and Clark, 1985). Hence exploration departs from existing knowledge (Levinthal and March 1993). Conversely, exploitation refers to incremental innovations that are designed to meet the needs of existing customers or markets (Jansen, 2005). It involves change that builds on established competence and focuses on improving established designs, introducing modifications to existing products and services, and increasing the efficiency of existing distribution channels (Abernathy and Clark 1985).

An ability to pursue both explorative as well as exploitative learning, and consequently explorative and exploitative innovation, is referred to as organisational ambidexterity (Jansen, 2005). Exploitation and exploration are defined as the most important capabilities in the innovation area (e.g., Atuahene-Gima, 2005). Previous research often regarded the trade-offs between these two activities as insurmountable, but more recent research describes ambidextrous organisations that are capable of simultaneously exploiting existing competencies and exploring new opportunities. Building upon earlier work by Duncan (1976), Tushman and O'Reilly (1996) were first to present a theory of organisational ambidexterity. They suggest that innovation occurs in roughly three distinct ways. First is incremental innovation in which an existing product or service is made better, faster or cheaper (Nelson and Winter, 1982). These improvements draw on an existing set of competencies and proceed along a known trajectory. A second way innovation occurs is through major or discontinuous changes in which major improvements are made, typically through a competence-destroying advance in technology (e.g., Tushman and Anderson, 1986). These improvements require competencies or skills different from what the incumbent firm has. Finally, innovation also occurs through seemingly minor improvements in which existing technologies or components are integrated to dramatically enhance the performance of existing products or services (e.g. Henderson and Clark, 1990). These so called architectural innovations, while not based on significant technological advances, often disrupt existing offerings (e.g. Christensen, 1997). Exploitation occurs when enterprises rely on existing competencies or operational capabilities to sell to existing customers. Over time, successful firms become knowledgeable of their customers and efficient at meeting their needs. However, in the face of competition and decreasing margins in their markets, enterprises often seek to move into adjacent markets by addressing new customer segments or through innovations that enable them to charge customers a higher price or reap higher margins (Reisch et al., 2009). Empirical studies suggest that the combination of exploration and exploitation is associated with longer survival (Cottrell and Nault, 2004), better financial performance (Govindarajan and Trimble, 2005), and improved learning innovation (Katila and Ahuja, 2002). From a resource-based view, the ability to pursue exploitation and exploration simultaneously is considered a valuable, rare and costly capability to imitate. Therefore it can be a source of competitive advantage (Simsek, 2009), and an organisation's long-term success may depend on its ability to exploit its current

capabilities while simultaneously exploring fundamentally new competencies (March, 1991).

Reisch et al. (2009) note that reaching a proper balance of exploration and exploitation is a difficult managerial challenge and it depends also on the external environment. Too much emphasis on exploration risks pursuing wrong ideas, and too much exploitation can lead to fatal missed opportunities. In slow moving environments, the need for exploration is reduced while in hyper-competitive situations it is heightened (Raisch, 2006).

Discussion on the antecedents to organisational ambidexterity provides conceptual foundation to its link to organisational foresight. First, the importance of the *external acquisition of new knowledge* is often emphasised. Studies on dynamic capabilities describe interrelations between internal and external knowledge processes that play an important role in corporate renewal or renewal of resources. Especially, research on exploration stresses the importance of the external acquisition of new knowledge (Raisch et. al., 2009). Rosenkopf and Nerkar (2001) found empirical evidence that exploration beyond organisational boundaries had more impact than exploration within organisations. Danneels (2008) tested the relationship between *environmental scanning*, which is a key component of organisational foresight, and exploration and it to be significantly correlated to this type of innovation.

Second, ambidexterity requires both internal and external knowledge processes as well as *knowledge integration across organisational boundaries* that can be associated to both strategic selection and integrative capabilities of organisational foresight. Henderson and Cockburn (1994) define 'architectural competence' as the ability to access new knowledge from outside the organisation's boundaries and the ability to integrate knowledge flexibly across boundaries within the organisation. Raisch et al. (2009) summarised that (i) ambidexterity may depend on the firm's ability to integrate internal and external knowledge bases; (ii) the ability to integrate external knowledge relies on a combination of external brokerage and internal absorptive capacity, and (iii) ambidexterity may be supported by social networks that contrast internal and external as well as strong and bridging ties. Tiwana (2008) suggested that strong ties are required to integrate knowledge, whereas bridging ties (or weak tie sources in the organisational foresight framework) are needed to access diverse, novel knowledge. Further, Tiwana (2008) proposes that strong ties complement bridging ties in enhancing ambidexterity.

Third, Gibson and Birkinshaw (2004) suggest that the capacities of ambidexterity develop through the creation of a particular type of organisational context broadly defined as the systems, processes, and beliefs that shape individual behaviours in an organisation. They relate this structural context to the establishment of administrative mechanisms that foster certain behaviours in employees, with emphasis on relatively tangible systems and processes such as incentive and career management systems. They also note that the *organisation's culture* captures the underlying belief systems and values of individuals in an organisation, rather than the formal systems and processes leaders put into place (Gibson and Birkinshaw, 2004). Especially, the role of *leadership* (e.g. Lubatkin et al., 2006) and *coordination* (Raisch et. al., 2009) has been stressed. Research into the drivers of ambidexterity found that decentralisation and densely connected social relations helps achieving ambidexterity (Jansen, van den Bosch et al., 2005, Tushman and O'Reilly, 1996), although exploitation has been also related to centralised structures (Ancona et al., 2001). Gibson and Birkinshaw (2004) found that the four behavioural framing attributes - stretch, discipline, support and trust - are positively related to the level of ambidexterity. Raisch et al. (2009) summarised five basic propositions on how strategic management and organisational context can contribute to organisational ambidexterity:

1. The presence of a compelling *strategic intent* that justifies the importance of both exploitation and exploration increases the likelihood of ambidexterity.

2. The articulation of a *common vision and values* that provide for a common identity increase the likelihood of ambidexterity. The operation of exploration and exploitation simultaneously increases the chances for conflict, disagreement, and poor coordination. Ameliorating this conflict requires a common set of values and shared meanings that provide a common identity, even though these values may foster different operating norms across the businesses (Podolny et al., 2001; Tushman and O'Reilly, 1997). Jansen (2006), for example, demonstrated that the provision of a shared vision was positively related to the successful pursuit of ambidexterity. In a study of exploration and exploitation, Sidhu et al. (2004) also found that a clear vision was an important determinant of success.

3. A clear consensus among the senior team about the unit's *strategy, relentless communication of this strategy, and a common-fate incentive system* increases the likelihood of ambidexterity. For example, to both sense and seize new opportunities, IBM has articulated a strategy of Emerging Business Organisations (EBOs) that

explicitly justifies to the entire organisation why the company needs to fund small, often money-losing new ventures that cut across lines of business (Harreld et al., 2007). IBM established a rigorous process to increase experimentation in new technologies and markets, to stop these ventures when they fail to meet milestones, or to integrate them back into mature units when they succeed (Raisch et. al., 2009).

4. Separate *aligned organisational architectures* (business models, competencies, incentives, metrics, and cultures) to explore and exploit subunits and targeted integration to increase the likelihood of successful ambidexterity.

5. *Senior leadership that tolerates the contradictions* of multiple alignments and is able to resolve the tensions that ensue increases the likelihood of ambidexterity. To succeed requires what Burgelman (2002) refers to as 'strategic debate' - the ability of senior leaders to encourage dissent and permit would-be champions to argue their points. For example, Danneels (2008) found a positive relationship between exploration and *constructive conflict* that refers to the debate of ideas, beliefs and assumptions by employees leading to mutual interest and understanding.

The competences and capabilities above, based on the existing empirical evidence, summarise the conditions under which organisational ambidexterity is likely to be successful. Raisch et al., (2009) notes that the leadership competencies required to manage the ambidextrous organisation are different than those needed to run either an exploratory or an exploitative business. In the latter, the fundamental issues are around achieving organisational alignment with the strategy - either around costs, efficiency, and scale or experimentation, risk and speed. In the ambidextrous form, managers must be 'consistently inconsistent', thus encouraging both exploitation and exploration. This capability, to both explore and exploit, helps firms to reconfigure existing assets and capabilities to sense and seize new opportunities. Thus, according to Raisch et al. (2009) ambidexterity can be considered a dynamic capability as well, without which, path dependence or structural inertia drive organisations toward continued exploitation – and, in the face of changing markets and technology – toward failure.

The literature review suggested that there has to be a positive relationship between organisational foresight and organisational ambidexterity, especially (a) between environmental scanning and explorative innovation, as well as (b) between integrating capabilities such as coordination and leadership and ambidexterity (given the emphasised role of leadership, coordination and visioning as being crucial for

ambidexterity). Since exploitation and exploration are two distinct types of innovation, their relation to organisational capabilities can be different. When striving for ambidexterity it is important to understand organisational foresight relations to both exploration and exploitation. Exploitation is essential for generating short-term results and incremental innovations and should not be overlooked. Exploration is essential to maintain a competitive advantage in the long term (Ahuja and Lampert, 2001) because it can generate radical, disruptive, discontinuous innovations. The next chapter will focus on the proposed relationship between organisational foresight and ambidexterity based on empirical evidence from studies on foresight.

2.3.3. Evidence on foresight's contribution to innovation and ambidexterity

The discipline of organisational foresight is largely concerned with the organisation's ability to explore and exploit opportunities within and beyond its immediate value network or domain of existing operations. A fundamental purpose of foresight is thus to minimise uncertainties or risks (Uotila et al., 2005). In fact, foresight highlights and maintains a focus on uncertainties so in that sense it does not minimize them. But it does minimize the chances of being surprised or harmed by unrecognized uncertainties. In general, a benefit is seen as soon as the results from the foresight activities are used for decision-making. Furthermore, the early warning provided and the created awareness of opportunities is a great benefit as such (Ashton, 1991). Foresight has therefore been heralded as a strategic practice that can lead to organisational transformation and renewal especially in high uncertainty environments (Roubelat, 2006; Godet, 2001; Sarpong, 2010). By virtue of its ability to explore uncertainties and identify opportunities organisational foresight can contribute immensely to the exploration and capture of value to sustain competitive advantage (Bodwell and Chermack, 2010; Day and Schoemaker, 2005; Sarpong, 2010), and it is believed to having a positive impact on innovation success (Brown and Eisenhardt, 1997).

Over the last decade scholars have drawn on various case studies and the extant foresight literature to show empirically how the foresight practice could lead to innovation (e.g. Van der Duin and den Hartigh, 2009; Drew, 2006; Van der Duin, 2006; Sarpong, 2010; Gracht et al., 2010, see Table 7). Especially, researchers often make commendable efforts to show how organisational foresight can contribute to the fostering of innovation by identifying various outcomes whose derived theoretical and

managerial implications they argue lead to innovations (e.g. Magnus and Kalevi, 2006).

Table 7. Knowledge on contributions of foresight to innovation

Authors	Research scope / Empirical context	Findings
Amsteus (2011)	Computer programming industry	Demonstrated that patents and licences are statistically significantly correlated with managerial foresight
Andriopolous and Gotsi (2006)	Product design consulting enterprise	Continuous learning and probing of the future leads to the rapid development of innovative products
Burmeister, Need, Beyers (2004)	The concept of corporate foresight	There are five 'innovation parameters' in which organisational foresight can contribute to the innovation process: the anticipation of future demand, higher quality through better information, context-orientation, timing, and the identification of strategic innovation networks
Clemons (1995)	Insurance enterprise	Foresight (scenario) analysis helps organisations in the management of strategic risks of reengineering
Daheim and Uerz (2006)	152 large European enterprises	An empirical study demonstrated that 57.5 percent of the respondents perceive organisational foresight as an improvement of the innovation process
Danneels (2008)	A survey of companies	Showed that environmental scanning is positively related to explorative innovation.
Drew (2006)	Telecommunication enterprise	Application of foresight methods leads to the identification of potential disruptive innovations in their early stages. Scenario techniques can be successfully applied to analysing disruptive innovation (although not limited to them) and the changes they can cause in industry structures and enterprise capabilities
Gracht (2010)	Expert interviews	Explored future organisational development trends in corporate foresight and innovation management. Concluded that there will be two main organisational development trends for corporate foresight and innovation management in the future: in traditional industries with conventional business models and long product life-cycles, enterprises will follow a different development path than enterprises in dynamic industries with innovative business models and short product-life-cycles.
Gruber and Venter (2006)	Organisational foresight in German enterprises from a management perspective	Enterprises do not make use yet of the full range of large content- and process-related, organisational and personal possibilities of futures research; three typical patterns of organisational foresight can be identified
Kaivo-oja (2006)	Role of foresight systems elements in relation to the innovation systems	Foresight and innovation systems can interact in different ways; foresight knowledge is not the only kind of knowledge needed for the innovation process; in different innovation models the strategic role of foresight knowledge is different
Neef and Daheim (2005)	Current developments of organisational foresight in Europe	Organisational foresight has become more widespread, professional and diverse; to be successful, organisational foresight must be integrated into organisational processes, such as strategy and innovation, as well as become more visible
Noori et al. (1999)	Electric motor vehicles	Organisations can develop breakthrough products and services by combining forecasts of quantifiable

Authors	Research scope / Empirical context	Findings
		environment variables with qualitative analysis of uncertainties through scenario creation
Partidario and Vergragt (2002)	Paint industry	Developed a scenario planning methodology that could be used to stimulate technological innovations through sustainability
Pirttimäki (2006)	Organisational foresight needs of industrial enterprises	Combining methods of product and service concept development with foresight methods can help to foresee innovations; organisational foresight can be utilised both in strategic planning and strategy implementation; a permanent foresight function should implement innovation foresight exercises
Rohrbeck (2010)	Case studies of European foresight-conducting enterprises	Suggested that corporate foresight as part of organisational future orientation is triggering innovative activities in enterprises.
Rohrbeck and Gemuenden (2011)	107 interviews with 19 multinational companies	Identified examples in which foresight performing the strategist role has permitted the firm to explore and plan the development of new business fields, and also showed how foresight performing the initiator role increases the ability to produce incremental innovation.
Roveda and Vecchiato (2006)	Foresight and innovation in the context of industrial clusters	Whereas interactive workshops and expert panels are best suited to foster incremental innovations, scenarios and other 'vision-oriented' methodologies are more appropriate when radical innovations are needed
Ruff (2006)	Automotive enterprise	Scenario thinking leads to early detection of risks, opportunities and the evaluation of innovative ideas. The strategic goal of innovation leadership requires an early detection of opportunities and risks; a future-oriented evaluation of innovation ideas follows five sequential steps: observation of future trends, trend impact analysis, idea generation, evaluation of innovations, and feasibility evaluation
Sarpong (2010)	ICT industry	Scenario thinking leads to productivity of product innovation teams
Van der Duin (2006)	Qualitative futures research for innovation	The level of integration of organisational foresight in the innovation process can vary between ad hoc, integration-method and full integration; the main function of futures research is to inspire and not to test the 'future-proofness' of ideas

Source: developed by author, partly based on Sarpong (2010) and Gracht et al (2010)

A review on the organisational foresight value revealed that the literature is quite extensive with respect to normative arguments about strengths and success of organisational foresight or specific foresight methods (especially scenario planning). However studies that empirically test and quantify the relationship between foresight and innovation are few. While these studies have made an invaluable contribution to enriching our understanding of the relationship between foresight and an organisation's ability to innovate, most of them simply make grand connections between organisational foresight or its specific methods and innovation but fail to show

exactly how and when the practice may lead to the innovations they often report (Sarpong, 2010). Several authors (e.g. Amsteus, 2011) conclude that most foresight literature refers to success stories, which are prescriptive and of anecdotal evidence, but weak from a scientific point of view. This research gap could possibly be attributed primarily to the fact that foresight is a practitioner-derived technique.

The previous sub-chapters suggested that the concepts of incremental and radical innovation are related to the processes of exploitative and explorative organisational learning. The notion behind explorative learning refers to discoveries, new undeveloped ideas, with little emphasis on improving internal competencies; and is principally associated with non-linearity of innovation. Conversely, exploitative learning is focused on improvements in knowledge by means of organic growth, resembling more a linear innovation path. In this respect it is important to consider the relational assets, for example organisational foresight, underpinning the processes through which either type of learning occurs in an externalised environment (Huggins and Johnston, 2010). Most research concerning the relation between organisational foresight and innovation has focused on radical explorative innovation (e.g. Drew, 2006; Roveda and Vecchiato, 2006). However, recent studies (e.g. Rohrbeck and Bade, 2012; Rohrbeck and Gemuenden, 2011) suggested evidence from case studies on *the relationship between organisational foresight and ambidexterity*, i.e. both explorative (radical) and exploitative (incremental) innovation. Also it is suggested that *organisational foresight has a role throughout the innovation development cycle* (from idea generation to idea implementation).

For example, Gracht et al (2010) states that there are two situations where organisational foresight can contribute to the innovation process: (a) before the idea is born and (b) when the idea is already established. In the first situation, organisational foresight is applied as a concept to inspire and create new ideas for innovation (Van der Duin, 2004b). As von Reibnitz (1988) indicates, organisational foresight provides comprehensive insight into the future development of the environment, which in turn induces ideas for new products and services. In the second situation, organisational foresight can help to assess either the commercial and technological viability and/or to adjust or abandon the innovation process (Van der Duin, 2004b). In these situations, organisational foresight helps to cope with uncertainty (Rohrbeck, 2010) by preventing enterprises from investing time, money and other resources in ideas that might not prove to be successful innovations in the future (Van der Duin, 2004b).

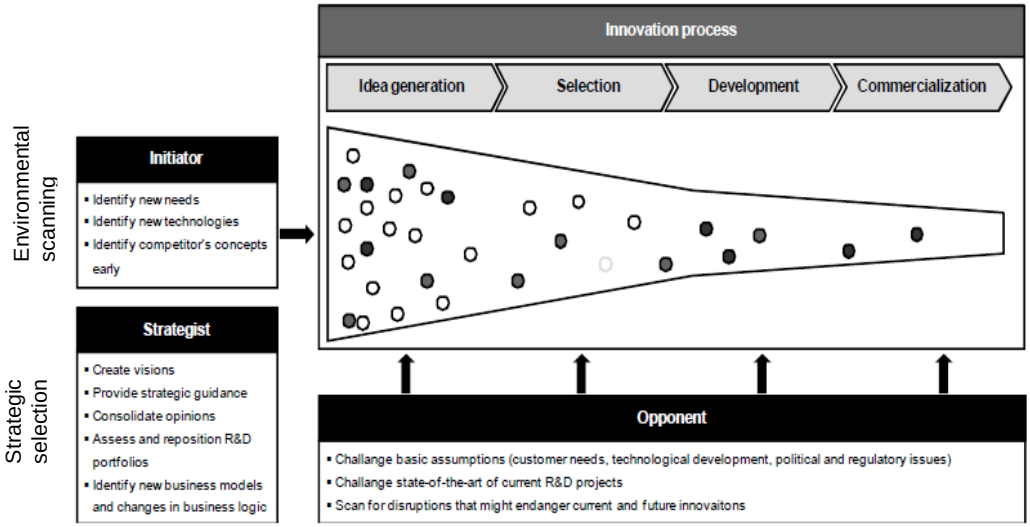
Rohrbeck and Gemuenden (2011) explored the ability of organisational foresight to increase the innovation capacity of a firm in their study on 19 European multinational companies. They differentiated into the capacity to innovate incrementally, i.e. enhanced or new products and services within current business field (exploitative innovation) and the capacity to innovate radically, i.e. creating products and services in new business fields often using new technologies (explorative innovation). They identified examples in which foresight performing the strategist role has permitted the firm to explore and plan the development of new business fields, and also showed how foresight performing the initiator role increases the ability to produce both incremental and radical innovation. Hence, their case study analysis found some support to the conceptual link between organisational foresight and ambidexterity.

According to Rohrbeck and Gemuenden (2011) the three roles can be positioned at the start of the innovation funnel (initiator role), outside the innovation funnel (strategist role) and along the innovation funnel (opponent role). Within these three roles, activities are conducted to boost the innovation capability of the company (see Figure 5).

In the *strategist* role, organisational foresight directs innovation activities by creating a vision, providing strategic guidance, consolidating opinions, assessing and repositioning innovation portfolios, and identifying the new business models of competitors. The strategist role is not directly linked to the innovation process. It provides guidance for the innovation effort and directs innovation activity toward new and promising business fields. To support the strategic review of R&D portfolios, emerging innovation opportunities are identified and compared with current R&D priorities and budgets. To provide strategic guidance, for example, Siemens produced visualisations of future product-usage scenarios - so-called ‘pictures of the future’ - that were used to direct and align the innovation effort throughout the company. In addition, organisational foresight can also help identify and assess disruptive new business models and alternative business logic. Running foresight projects produces a benefit through the process itself. By engaging several internal stakeholders, an internal discussion is triggered that helps to consolidate opinions. A further impact is the vision creation, which differs from providing strategic guidance, because it is left unspecific. Some companies reported aiming for a certain fuzziness in order to emphasise the uncertainty and ensure that the visions would inspire its employees to

create the future by working in the direction of the vision, rather than discouraging them with clear long-term goals (Rohrbeck and Gemuenden, 2011).

Figure 5. The three roles of organisational foresight in innovation management



Source: Rohrbeck and Gemuenden, 2011

In the *initiator* role, organisational foresight triggers innovation initiatives by identifying new customer needs, technologies, and product concepts of competitors. The initiator triggers new innovation initiatives, including new R&D projects and new process or business model innovations. In so doing, he feeds the innovation funnel, which in turn is the basis for an increase in quantity and quality of innovative output. The most quoted impact is the identification of new customer requirements through analysing cultural shifts and collecting the needs of lead customers. The second impact is the identification of emerging technologies by scanning the science and technology environment. A third cluster of impacts is the identification of new competitor concepts by monitoring R&D projects, patenting activities, and the new product launch announcements of the competitors.

In the *opponent* role, organisational foresight challenges the innovators to create better and more successful innovations by challenging basic assumptions, challenging the state-of-the-art of current R&D projects, and scanning for disruptions that could endanger current and future innovations. The opponent role has an impact throughout the innovation process (see Figure 5). In addition to challenging basic assumptions of

innovators, organisational foresight plays the opponent role when it identifies technologies, products, or changes in the consumer needs domain that have disruptive potential. Further, it aims to ensure the state-of-the-art of R&D projects. For example, one company employs a team who scan the environment and regularly participate in new project presentations, project milestone meetings, and review workshops, where they challenge the current activities with what they have observed in the environment or what is already available in lead markets and thus increase the probability that the R&D projects will produce state-of-the-art innovations (Rohrbeck and Gemuenden, 2011).

2.3.4. Summary: links between foresight, innovation and learning types

Some important conclusions can be derived from this literature review. First, the conceptual discussion on what organisational context is required to focus on exploration and exploitation simultaneously suggested that there is a positive relationship between organisational foresight capabilities and organisational ambidexterity. Since exploitation and exploration are two distinct types of innovation, their relation to organisational capabilities can be different. When striving for ambidexterity it is important to understand organisational foresight relations to both exploration and exploitation. Specifically, a positive relationship between environmental scanning and explorative innovation is emphasised, which is supported by empirical evidence (e.g. Danneels, 2008; Middelbeek, 2010), as well as between integrating foresight capabilities such as coordination and leadership and ambidexterity, given the importance of the role of leadership, coordination and visioning for ambidexterity. Second, empirical evidence based on case studies investigating organisational foresight in multinational enterprises suggested that organisational foresight has a role throughout the whole innovation development cycle (Gracht et al, 2010), and it can contribute to both explorative and exploitative innovation (Rohrbeck and Gemuenden, 2011).

Organisational foresight can be applied to inspire and create new ideas for radical innovation (Van der Duin, 2004b) by providing comprehensive insight into the future development of the environment. Also, it can help challenging and assessing the existing research and innovation projects and induce incremental changes (Van der Duin, 2004b). This has led to the conclusion that the interplay of organisational foresight and innovation management activities can contribute to organisational

ambidexterity. Building on the above propositions, Table 8 summarises the link between organisational learning strategies (explorative and exploitative), innovation type and the role of organisational foresight and its capabilities.

Table 8. Link between foresight, organisational learning and innovation types

Organisational learning	Innovation type	Organisational foresight role in the innovation development	Capabilities required for this role
Explorative learning – captured by search, risk taking and discovery, new undeveloped ideas, with little emphasis on improving internal competencies; non-linear, radical innovations designed to meet the needs of emerging customers and markets (Danneels, 2002; March, 1991).	**Explorative (radical) innovation** - novel (dissimilar from prior innovations); unique (dissimilar from current innovations); adopted (has the power to influence future innovations) (Dahlin and Behrens, 2005).	Mainly initiator role and innovation ideas generation. Scanning for disruptions that could endanger current and future innovations. Generates new innovation initiatives, including new R&D projects and new process or business model innovations. Also plays strategist role by creating and communicating vision.	Mainly environmental scanning capabilities. Strategic selection capabilities (e.g. visioning) and integrating capabilities (e.g. leadership) also play a role.
Exploitative learning - involves change that builds on established competence. Refers to incremental innovations that are designed to meet the needs of existing customers or markets (Jansen, 2005).	**Exploitative (incremental) innovation** - refining and improving an existing technology; a small change or a reconfiguration of an established system to link together existing components in a new way (Henderson and Clark, 1990).	Mainly opponent role and idea evaluation. Encourages to create better and more successful innovations by challenging basic assumptions, challenging the state-of-the-art of current R&D projects.	Mainly integrating capabilities. Environmental scanning and strategic selection (esp. analysing) capabilities also play their role.

Source: developed by the author

Third, even though past research has strived to establish a positive relationship between foresight and ambidexterity, this relationship has never been tested by higher constraint research designs. Only parts of this relationship have been tested with quantitative means. Thus, despite the theoretical and empirical basis for the positive relationship between foresight and ambidexterity is becoming more apparent, empirical evidence on such relationship is lacking. This justifies the purpose of the dissertation, which is to contribute to theory testing by determining the relationship between organisational foresight and ambidexterity. Building on these conclusions, the next Chapter proposes the research model and lists the hypotheses on the structural relationships within the model.

3. STRUCTURAL RESEARCH MODEL

This Chapter proposes the structural research model, which is deductive to the extent that it is based on the literature review. The theoretical (conceptual) framework for analysis guides subsequent data collection and analysis. The structural research model explains main factors, constructs and variables to be studied, as well as relationships among them (ct. Miles and Huberman, 1994).

3.1. Structural model of organisational foresight capabilities

The structural research model aims at explaining organisational foresight and its impact on explorative and exploitative innovation. The model focuses on three clusters of capabilities at the most comprehensive analytical level: (i) environmental scanning, (ii) strategic selection and (iii) integrating capabilities. They are core concepts in two streams of relevant research: organisational foresight (e.g. Grim, 2009; Rohrbeck, 2010) and dynamic capabilities (Teece, 2007).

Environmental scanning capabilities are driven by the underlying processes of scanning - the activity of learning events and trends in the organisation's environment which facilitates market and technological opportunity recognition (Danneels, 2008). This dissertation defines it as the extent to which a company deploys strong and weak tie external sources of information covering a stretch of time horizon from near to long term future. Competitive and technological uncertainties make it difficult to determine which external resources are most likely to support innovative products that are relevant for existing or emerging markets (Teece et al., 1997), therefore companies need external / environmental scanning capabilities for recognising valuable sources of external knowledge. The ability to sense opportunities requires the constant surveillance and monitoring of markets and technologies (Teece et al., 1997). External scanning processes enable companies to identify and recognise new and emerging markets and technologies (Danneels, 2008). Such intelligence drives the ability to sense opportunities for innovation.

Further challenge is to recognise the value of new knowledge, absorb it and integrate it into their internal strategic and innovation development processes. When new opportunities are first identified, companies need to gather and filter technological, market, and competitive information to figure out implications for action (Cepeda and Vera, 2007). In particular, firms need to analyse external knowledge and conduct

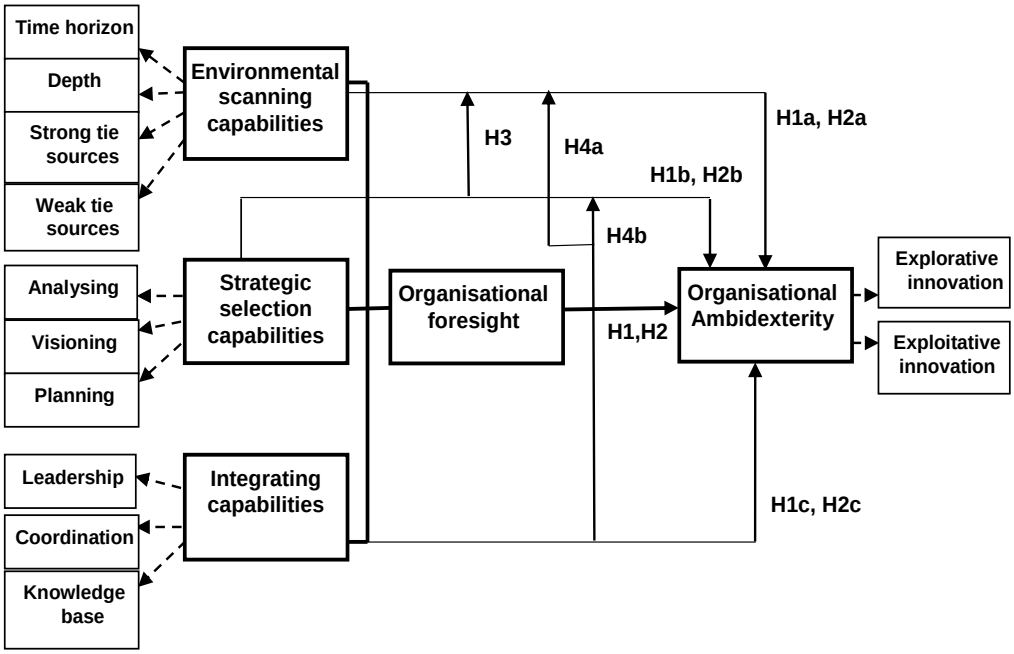
strategic selection processes (Capron and Mitchell, 2009). Therefore, the **strategic selection capabilities** are driven by the organisational activities - analysing, visioning and planning - involved in identifying a preferred alternative for organisational change (Zott, 2003; Grim, 2009; Amsteus, 2011). Strategic selection leads to a decision of what needs to be done internally and what can be insourced from the external sources and, therefore, facilitates the capacity to shape opportunities for innovation.

Once external knowledge is identified and selected, the **integrating capabilities** play an important role in diffusing, replicating, and maintaining this knowledge within the organisation (Cepeda and Vera, 2007). The existing knowledge base supports the articulation and codification of external knowledge resources (Cohen and Levinthal, 1990). In addition, effective incorporation of external resources requires the integration of these resources into the firm's culture (Zahra et al., 1999). Employee resistance and conflicts regarding how to obtain and assemble resources can be overcome by effective leadership - corporate values, effective communication, and reward systems help determining the channels and types of knowledge that are tolerated and encouraged (e.g. Rohrbeck, 2010). Effective incorporation also requires coordination processes which include the assignment of roles and tasks, and an organic architecture for external knowledge implementation (Eisenhardt and Brown, 1999). Coordination processes have been shown to enhance the speed and efficiency of resource transfer (Verona and Ravasi, 2003; Rohrbeck, 2010). Hence, leadership, knowledge base and coordination are suggested to facilitate the integrating capabilities. Integrating refers to the organisational leadership, coordination capabilities as well as the existing knowledge base for integrating resources to create and capture value from opportunities – Teece also calls it 'seizing' (Teece, 2007).

This study proposes a structural model for testing the relationship between organisational foresight and organisational ambidexterity. A formative second-order research model is proposed, which constitutes a coherent and parsimonious depiction of the multidimensional nature of organisational foresight. A second-order model is suggested as clusters of organisational foresight reside at a higher level of abstraction than their underlying processes. The reasoning for formative modelling is threefold: firstly, the first-order constructs represent distinct processes that are not interchangeable. Secondly, first-order processes are not necessarily correlated. Thirdly, underlying processes enable the higher-order capability to occur (Baxter, 2009). By conceptualising and measuring organisational foresight in terms of their

underlying processes, activities and traits the conceptual richness of the constructs can be captured, and at the same time making them less confusing. While the abstract higher-order constructs of environmental scanning, strategic selection and integrating capabilities are theoretically relevant, the lower order constructs describe specific and observable characteristics in organisations. The proposed model and hypotheses on the structural relationships are depicted in the Figure 6.

Figure 6. Structural research model



Organisational ambidexterity is referred to as ability to pursue both explorative as well as exploitative innovation (Jansen, 2005). Exploration is captured by the terms of search, risk taking and discovery and refers to radical innovations that are designed to meet the needs of emerging customers and markets (Danneels, 2002). It departs from established systems of production and existing knowledge, and opens up new linkages to markets and users, offers new, sometimes disruptive, products, and develops new channels of distribution. Conversely, exploitation refers to incremental innovations that are designed to meet the needs of existing customers or markets (Jansen, 2005). It involves change that builds on established competence and focuses on improving established designs, introducing modifications to existing products and services, and increasing the efficiency of existing distribution channels (Abernathy and Clark, 1985). From a resource based view the ability to pursue exploitation and

exploration simultaneously is considered a valuable, rare and costly to imitate capability. Therefore organisational ambidexterity can be a source of competitive advantage (Simsek, 2009).

The hypotheses proposed with respect to the structural relationships between the organisational foresight capabilities and organisational ambidexterity (explorative and exploitative innovation) are discussed next.

3.2. Hypotheses on structural relationships

Decisions concerning new knowledge on emerging markets and innovation are characterised by uncertainty, complexity, and organisational conflict (Amit and Schoemaker, 1993). Increasingly, external networks and other external sources can provide companies with access to new knowledge and technologies (Zander and Zander, 2005). Environmental scanning capabilities can help to obtain such access by applying systematic processes of external scanning. With the growing flow of information facilitated by technological developments, the challenge for firms is not always producing new information rather it is to recognise and use relevant innovative information (De Bondt, 1996). Scanning the environment can increase the amount of ideas that produce innovation, but few innovative ideas actually make it to implementation. Strategic selection capabilities enhance the identification of emerging opportunities that fit with the company's strategy. Hence, the more and the better the company scans the external environment and selects appropriate opportunities, the more access it will obtain to new knowledge which will contribute to innovation performance.

Empirical evidence based on case studies investigating organisational foresight in multinational enterprises suggested that organisational foresight can contribute to both explorative and exploitative innovation (Rohrbeck and Gemuenden, 2011). Organisational foresight can be applied to inspire and create new ideas for radical innovation (Van der Duin, 2004b) by providing comprehensive insight into the future development of the environment. A positive relationship between environmental scanning and explorative innovation was supported by studies of Danneels (2008) and Middelbeek (2010). Also, organisational foresight can help challenging and assessing the existing research and innovation projects and induce incremental changes (Van der Duin, 2004b). In addition to challenging basic assumptions of innovators, environmental scanning supports the opponent role to existing products and R&D

projects when it identifies technologies, products, or changes in the consumer needs domain that have disruptive potential. Integrating foresight capabilities such as coordination and leadership (Reisch et al., 2009), and strategic selection capabilities such as visioning (Jansen, 2006; Sidhu et al, 2004) are expected to contribute to both types of innovation. Jansen et al. (2006), for example, demonstrated that the provision of a shared vision was positively related to the successful pursuit of ambidexterity. In a study of exploration and exploitation, Sidhu et al. (2004) found that a clear vision was an important determinant of success. Thus, it is expected that organisational foresight will have a positive effect on both explorative and exploitative innovation. Moreover, a positive relationship between ambidexterity and all three groups of foresight capabilities can be expected.

Hypothesis 1: There is a positive relationship between organisational foresight capabilities and organisational ambidexterity (explorative and exploitative innovation).

Hypothesis 1a: There is a positive relationship between environmental scanning capabilities and organisational ambidexterity.

Hypothesis 1b: There is a positive relationship between strategic selection capabilities and organisational ambidexterity.

Hypothesis 1c: There is a positive relationship between integrating capabilities and organisational ambidexterity.

A review of literature suggested highest impact of organisational foresight (especially the environmental scanning capabilities) on the development of radical innovation and explorative learning routes (e.g. Drew, 2006; Roveda and Vecchiato, 2006). Therefore the following hypotheses are formulated:

Hypothesis 2: The positive relationship between organisational foresight and explorative radical innovation is stronger than the positive relationship between organisational foresight and exploitative innovation.

Hypothesis 2a: The relationship between environmental scanning and explorative innovation is stronger than the relationship between environmental scanning and exploitative innovation.

Hypothesis 2b: The relationship between strategic selection and explorative innovation is stronger than the relationship between strategic selection and exploitative innovation.

Hypothesis 2c: The relationship between integrating capabilities and explorative innovation is stronger than the relationship between integrating capabilities and exploitative innovation.

Implementation of organisational foresight systems remains limited (Day and Schoemaker, 2005; Becker, 2002; Reger, 2001; Daheim and Uertz, 2008; Rohrbeck, 2010) as building an organisational structure that facilitates an effective response proves challenging. Value-creating scanning capabilities do not only derive from access to new knowledge, but are particularly dependent on how new knowledge is analysed and if the specific processes of choosing and preferred vision and acting on it are applied by organisations (Teece et al., 1997; Grim, 2009;Rohrbeck, 2010). Hence, companies also require strategic selection (analysing, visioning and planning) capabilities to make better use of new knowledge (Grim, 2009; Amsteus, 2011) and to be able to effectively incorporate external knowledge into their own innovation processes. Without these capabilities, the value of environmental scanning can be limited.

Hypothesis 3: Strategic selection moderates the relationship between environmental scanning and organisational ambidexterity, such that the relationship is weaker under conditions of low strategic selection and stronger under conditions of high strategic selection.

Another explanation for the persistent gap between perceived importance of organisational foresight and its implementation is the lack of organisational incentives that would foster the usage of anticipatory information for generating effective response (Rohrbeck, 2007, 2010). The capabilities to integrate external knowledge are captured by the underlying processes and characteristics of leadership and coordination. Jointly, these processes and characteristics allow companies to make better use of their access to external knowledge and to isolate them from competing firms. Hence, the more firms coordinate, integrate, and maintain externally sourced knowledge, the more likely it is that they will be assimilated into high-performing innovation capabilities. However, integrating capabilities are also path-dependent. Previously obtained knowledge base puts bounds around what types of new knowledge can be exploited (hence, integrated). This notion is strengthened by the concept of absorptive capacity, which encompasses a set of organisational processes aimed at maximising the added value of externally acquired knowledge. The concept of absorptive capacity was defined by Cohen and Levinthal (1990) as the ability of an

enterprise to recognize the value of new, external information, assimilate it, and apply it to commercial ends (Cohen, Levinthal, 1990). Absorptive capacity is seen as a promising explanation of innovation (Tsai, 2001), business performance (Lane, Salk and Lyles, 2001; Tsai, 2001), and inter-organisational learning (Lane and Lubatkin, 1998). Following the argument of Cohen, Levinthal then, it is enterprises with higher absorptive capacities are more likely to establish linkages and gain the most from the external sources of knowledge. Integrating capabilities are thus important enablers of foresight success. Literature associates integrating capabilities with internal organisational culture and the human component, which can to some extent act as a substitute for formal foresight processes. Scholars from both ambidexterity (e.g. Reisch et al., 2009; Gibson and Birkinshaw, 2004; Jansen, van den Bosch et al., 2005, Tushman and O'Reilly, 1996) and foresight research (e.g. Day and Schoemaker, 2005; Rohrbeck, 2010) stress the role of leadership and coordination. Thus, the strength of leadership, coordination and knowledge base is expected to interact in determining ambidexterity. As a consequence, these integrating capabilities are suggested to moderate the relationship between foresight and ambidexterity.

Hypothesis 4a: Integrating capabilities moderate the relationship between environmental scanning and organisational ambidexterity, such that the relationship is weaker under conditions of low integrating capabilities and stronger under conditions of high integrating capabilities.

Hypothesis 4b: Integrating capabilities moderate the relationship between strategic selection and organisational ambidexterity, such that the relationship is weaker under conditions of low integrating capabilities and stronger under conditions of high integrating capabilities.

4. RESEARCH METHODOLOGY

This Chapter provides detailed description of the research methodology. It evolves from the metaphysical topic of ontology, over epistemology to the more operational topic of research methodology. Together, they describe the research strategy that supports this dissertation. Firstly, the aims and objectives of the empirical research are provided, the philosophical stance is presented and arguments are provided for selecting the philosophical and methodological approach. Secondly, the measures and the scale development process are described, as well as preconditions for data reliability and validity. Finally, the research sample and its justification is provided.

4.1. RESEARCH DESIGN

4.1.1. Research aim and objectives

The fundamental research question addressed in this dissertation is: *what is the relationship between organisational foresight and organisational ambidexterity*. The research study addresses the construct of organisational foresight and focuses on the scientific problem of exploration of the relationship between foresight and organisational ambidexterity, to understand what organisational foresight capabilities relate to the explorative and exploitative innovation.

Empirical research study addresses the following objectives related to the main aim of the thesis:

1. To examine how the relationship between organisational foresight and organisational ambidexterity can be measured by developing and validating a measurement scale.

2. To propose a finalised conceptual model of organisational foresight's relationship to organisational ambidexterity.

3. To empirically test the relationship between organisational foresight and organisational ambidexterity.

4.1.2. Philosophical stance

Proctor (1998) considers that consistency between the aim of research study, the research questions, the chosen methods, and the personal philosophy of the researcher is the essential underpinning and rational for any research project. The philosophical level of a research design relates to its assumptions based on the most general features of the world, such as the matter, reality, truth, nature of knowledge and proofs of knowledge (Hughes, 1994). The approach may be dependent on the nature of study and the questions asked. The researcher experience, understanding of philosophy and personal beliefs may also have some bearing on the method adopted (Denzin and Linkoln, 1994). Shih (1998) lists four areas of consideration when deciding on a research method: the philosophical paradigm and goal of the research, the nature and the phenomenon of interest, the level and nature of the research questions, and practical considerations related to the research environment and the use of resources. Before describing the selected research design, the philosophical stance of the study is explained.

The research is contextualised by the scientific philosophy of positivism. This philosophical approach to the creation of knowledge can be characterised by an emphasis on empiricism – that is knowledge based on empirical observation, testing of theories and development of universal laws. This meta-theoretical approach is chosen for a number of reasons as explained below.

Concerning the research type, a comparison can be made of inductive research, i.e., research aimed at identifying new phenomena, and deductive research, i.e., research aimed at testing phenomena. In inductive research, a further differentiation is made into conceptual work and empirical work using for example case studies. Concerning the maturity of futures research discipline, the field where the concept of foresight originates from, it can be seen that most of the research to date has been inductive, thus aimed at theory development. Only some specific phenomena, such as the characteristics of environmental scanning (Danneels, 2008), or the relationship between managerial foresight and organisational performance (Amsteus, 2011) have been studied with deductive means. This leads to the conclusion, also noted by Rohrbeck (2010), that the research discipline has not reached maturity yet, but can be classified as being at the transition from theory development to theory testing. As mentioned in the Introduction and Chapter 2 of the dissertation, current knowledge in

the field of organisational foresight and its link to innovation has taken the form of previous and increasing numbers of theoretical writings. Available empirical research is often based on case studies. Consequently, as the concept has already been addressed through lower constraint designs, the refinement of research questions to allow higher constraint was deemed central, in order to move from theory development phase to theory testing (Amsteus, 2011).

According to Bryman (2008), Onwuegbuzie and Leech (2005), the selected approach suggests the characteristics of the research design (objective, impersonal, reductionist and generalisation, fixed and high constraint designs), the epistemological choices (empiricist) and ontological choices (realist / objectivist). According to Tuli (2010) positivists use the criteria of validity, reliability, objectivity, precision, and generalisability to judge the rigor of quantitative studies as they intend to describe, predict, and verify empirical relationships in relatively controlled settings.

4.1.3. Research design

Research design provides the glue that holds the research together (Trochim, 2005). A design is used to structure the research, to show how all of the major parts of the research - the sample, measures and methods - work together to address the central research questions. There are various research designs to consider, including naturalistic observation, case study observation, correlational research, differential research, and experimental research (Graziano and Raulin, 1993). Graziano and Raulin (1993) claim that, within science, ways for acquiring information range from the lowest to highest demand made on the quality of information and the character of treatment. In essence, there is a trade-off between flexibility and precision – or constraints. Lower constraint research procedures (e.g. observational, case study research) can be deployed to demonstrate a new research technique, or to examine the generalisability of the theories previously developed by higher constraint research, or to collect knowledge on the specific case at the beginning stages of research in a new area. These designs are relatively flexible, but the major weakness of low constraint methods is poor representativeness (Graziano and Raulin, 1993). In short, the choice of appropriate level of research design depends upon the research question and the level of knowledge already available in the area of research. The research question should be refined so that it can be answered using the highest constraint level

possible, given both current knowledge in the field, practical as well as ethical constraints of the researcher (Graziano and Raulin, 1993).

As mentioned in Chapter 2, the concept has already been addressed through lower constraint designs, thus the refinement of research questions to allow higher constraint was deemed central. The most constrained design deployed in this research is correlational, i.e. a multivariate across sectional survey design. The choice of design culminating in the multivariate correlational / regressional study is in accordance with the overall research question and purpose, as well as in line with striving towards a highest constraint level.

The broken down research questions are devised so that answering each question makes the succeeding question possible, in a stepwise fashion, culminating in a multivariate quantitative survey. The research process can be described in three steps, corresponding to the broken down research questions.

Firstly, the preliminary *conceptual framework* and a *structural research model* were developed and described, based on an in-depth review of existing body of knowledge. As more knowledge was deemed necessary with regard to the definition of organisational foresight capabilities and as the concept of organisational foresight was deemed not to have a definition clear enough to allow quantitative measurement, the research process began with a review of previous research, with the employment of logic to arrive at such definition. The completion of this step meant that it was possible to address the second research question. The theoretical constructs and preliminary measures related to the linkages between the constructs are proposed (see Chapters 2 and 3).

Second, the measurement scale for validating the model was proposed and the preliminary survey questionnaire was developed. Drawing on the theoretical definition of organisational foresight and following the procedure proposed by Dilmann (2007) and Churchill (1979), as well as applying the scales already applied in the previous research, scales for measuring organisational foresight capabilities were constructed.

Third, the proposed conceptual framework as well as its measures and scales were validated by (i) piloting a survey questionnaire with the help of two semi-structured ‘think aloud’ interviews with managers in the selected enterprises, and (ii) conducting a pilot study with 28 company managers. Information from the interviews was used for measure purification, pre-test testing, and scale validation. Based on the pilot study results, the measurement instrument and the research model were refined.

The interviews and pilot study also served as a tool for assessing the validity of the measurement instrument.

Fourth, a multivariate quantitative *survey* was carried out for testing the research hypotheses. A sample of enterprises was generated and limited through a restrictive enterprise database research. The survey was conducted using telephone calls. Employing the scales developed in steps 2 and 3, organisational foresight was tested for relationship with organisational ambidexterity. The outcome of this fourth step was the hypothesis on the positive relationship between organisational foresight and organisational ambidexterity approved, and links between the different foresight capabilities (environmental scanning, strategic selection and integrating capabilities) and organisational ambidexterity explored. The research results was analysed using statistical analysis software SPSS (Statistical Package for the Social Sciences) 21.0 and Stata 12.0 statistical analysis software. The conclusions answering the research objectives were drawn based on the survey results, and the recommendations on future research as well as practical recommendations for managers were proposed.

Taken together, these steps address the overall research problem and research objectives of the dissertation. The next Chapter discusses the research instrument.

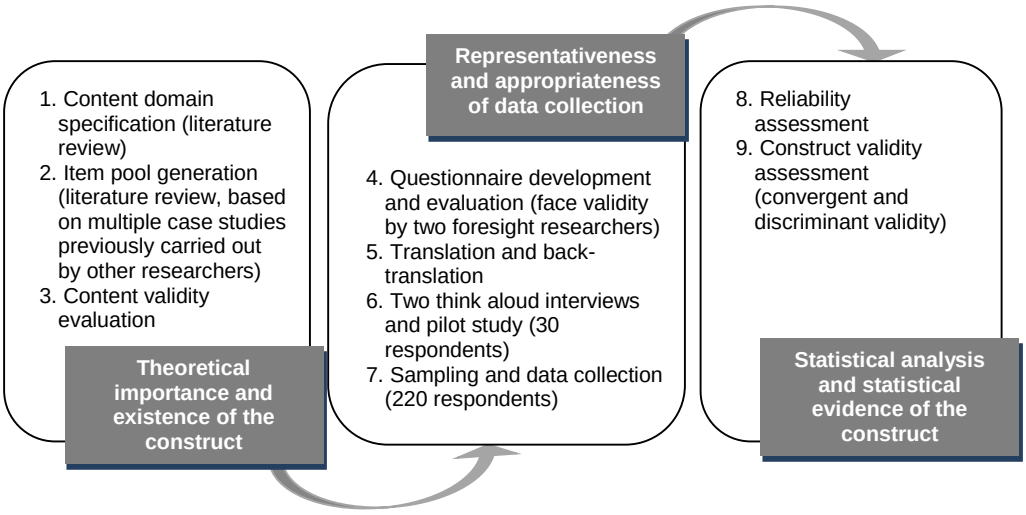
4.2. RESEARCH INSTRUMENT

4.2.1. Measures

Measures are defined as an observed score gathered through self-report, interview, observation, or other means (Edwards et al. 2000). Measures are quantifiable, for example, an empirical score gathered from a survey instrument. Measures, also called indicators or scale items, can be distinguished as either ones that are influenced by (reflect) or influence (form) latent variables (Bollen et al. 1991). We therefore distinguish between formative and reflexive measures. In the formative measurement model, the indicators influence the construct. These are often called ‘causal’ indicators and the construct is often termed as a composite variable (MacKenzie et al. 2005). This means that the measures cause the construct and that the construct is fully derived by its measurement.

Wherever possible, measurement items were adapted from existing scales. For new measures, standard scale development procedures were used (e.g. Churchill, 1979; Dillmann, 2007).

Figure 7. Steps adopted in scale development for first-order variables



The first step regarded the content domain specification since the development of a new measure starts with outlining the domain of the new construct. It was achieved by an in-depth literature review. This step consisted of by providing a definition of the new construct. Based on the literature review, a large pool of potential items was developed. From this pool of items, scales were constructed. Discussions were conducted with two academics to discuss the appropriateness of these new measurement items. In addition, the questionnaire was tested during two think aloud interviews with company managers pilot-tested with 30 company managers (see section 4.2.2.3). At this stage, the final measures were proposed (see sections 4.2.1.1-4.2.1.5). Reliability and validity assessments were conducted after the data collection stage, and consisted of testing Cronbach's alphas and conducting factor analysis (see section 5.3).

All items were rated on 7-point ordinal Likert-type scales (e.g. 1 = agree completely and 7 = disagree completely as anchors), except for the access to external funds, where a yes/no answer was asked. A seven point scale was used to create uniformity throughout the questionnaire (Dillman, 2007), whereas some of the original instruments used different scales. Having different scales for parts of a survey could be confusing to respondents and could create some difficulties in statistical analysis.

Environmental scanning

The second order formative construct of *environmental scanning* was formed of four variables: (1) time horizon; (2) depth; (3) strong tie sources; (4) weak tie sources.

Time horizon. Time horizon describes the time scale of environmental scanning focused on different time horizons – from short term (up to one year) to long term (up to more than 15 years in the future) (based on Rohrbeck, 2010). Most scholars report organisational foresight having a role in both the long term and medium term (e.g. Ruff, 2006). Some expect the time horizon to be dependent on the industry (Becker, 2002), and others emphasize the importance of foresight for the short-term planning, because the scanning system has inherent blind spots and foresight is needed to regularly scan these areas (e.g. Day and Schoemaker, 2004, 2005). In the managerial foresight scale proposed by Amsteus (2011), managers are asked to take into account future conditions, plans and objectives that are at least 2 years in the future. This study takes the view of Rohrbeck (2010) that environmental scanning should play a role in all time horizons of strategic planning. Scanning for different time horizons creates the possibility for companies to detect changes at different stages of their development, which facilitates building comprehensive strategies to react to them (Rohrbeck et. al, 2009). Hence, a four-item time horizon scale proposed by Rohrbeck (2010) and Amsteus (2011) was adapted. According to multiple cases reported by Rohrbeck (2010), a short-term planning process plans the next fiscal year and includes a small amount of strategic planning. A medium-term planning process, which plans 3–5 years ahead and is focused on evaluating current markets. The result is often a strategic plan which shifts emphasis from one business field to another. A long-term planning process, which looks more than 5 years ahead, plans the road toward future markets, and proposes measures to deal with potential disruptions.

Depth of scanning. Depth of scanning describes focusing on wide scope of environmental scanning, including the areas that currently seem to have no relevance to the company but which could breed disruptive changes that are difficult to perceive and to prepare for (Reger, 2001; Rohrbeck, 2010). First, it can be described by differentiating into current business, adjacent business, and white spaces (Reger, 2001; Rohrbeck, 2010). White spaces are areas that currently seem to have no relevance to the company but which could breed disruptive changes that are difficult to perceive and to prepare for. The scope is represented by four segments: political,

technological, consumer, and competitive environment (Becker, 2002; Jain, 1984; Rohrbeck, 2010). Depth was constructed of three scale items adapted from Rohrbeck (2010).

Weak tie sources. Companies need to consciously choose appropriate external sources of information. These sources can be differentiated by weak tie and strong tie sources. Danneels (2008) proposed a six-tem scale to assess the extent to which the firm's employees access outside information regarding technological and market trends through external sources. Rohrbeck et. al. (2009) used 8 items to measure informal sources (internal networks; personal contacts and networks; conferences, exhibitions and seminars; customer and expert interviews; public R&D programs; expert panels; university-industry collaborations; R&D collaborations and joint ventures).

Weak tie sources are described as exploiting external sources of information with which the companies typically have little contact, but they can nevertheless provide conceptually new information (Ansoff, 1975; Hansen, 1999). In this research weak tie external scanning sources are measured using the 5 item scale, where three items (professional association activities, scientific or professional conferences, scientific community) are adapted from Danneels (2008), and two items (expert surveys, patents) are adapted from Rohrbeck (2009). An expert is a person with extensive knowledge or ability based on research, experience, or occupation in a particular area of study, called in for advice on their respective subject.

Strong tie sources. Strong tie sources describe exploiting sources of information with which companies typically have many social acquaintances in their everyday work and/or which generate familiar information (based on Julien et al., 2004). The five item scale is developed based on the studies reviewing OF practices in companies produced by Daneels (2008); Delgado (2011) and Rohrbeck (2009). One item (Internet and media search) is adapted from Rohrbeck et. al. (2009), two items (trade shows, specialised journals and magazines) are adapted from Danneels (2008), and two items (suppliers and customers) are adapted from Delgado (2011).

Strategic selection

The second order formative construct of *strategic selection* is formed of three variables: (1) analysing; (2) visioning; (3) planning.

Analysing. Amsteus (2011) suggested six items to measure the analysis variable in the managerial foresight construct, which takes into account what part of the facts on the past, potential future conditions, plans and targets are analysed by managers. Grim (2009) suggested forecasting as part of the foresight maturity model and defined it as a description of long-term outcomes that contrast with the present to enable better decision-making. In this research analysing is described as interpreting the collected data on future conditions and describing baseline and alternative futures: drivers and uncertainties, implications and outcomes (based on Bishop et al., 2007). A four item scale measuring analysing is developed based on the studies produced by Bishop et al. (2007) and Amsteus (2011). Three of these items include main methods used for analysis of collected data and forecasting (econometric modelling; simulation; scenarios; systems models or systems analysis). One item investigates whether companies analyse in detail potential future conditions (according to Amsteus, 2011).

Visioning. Grim (2009) suggested visioning as an important part (step) of the foresight maturity model. According to Grim (2009), visioning should include these steps: (1) elicit and incorporate goals, values, and aspirations of stakeholders; (2) surface the underlying assumptions, espoused beliefs and values, and operational artifacts which establish the culture; (3) articulate the unique contribution that frames the organisation's view moving forward; (4) craft the vision in a manner that is both inspirational and motivational, resonating with the hearts and minds of those who will follow it. Rohrbeck et al. (2009) measured vision generation as one of the foresight methods in his study. In this study visioning is defined as choosing a preferred vision of the company's future: envisioning the best outcomes, goal-setting, performance measures (based on Bishop et al., 2007). The scale measuring visioning consists of four items, based on Bishop et al. (2007), Gibson and Birkinshaw (2004), Sinkula, Baker and Noordewier (1997), and measures: (1) if the company sets long term objectives that are consistent with its vision and values; (2) if there is a systematic vision development process; (3) if visioning methods are applied, for example balanced scorecard, appreciation inquiry, road-mapping; (4) if there is total agreement on organisational vision across all levels, functions and divisions.

Planning. Planning is defined as deployment of organisational routines ensuring that the company's actions, skills, and processes support the long term organisational vision (based on Grim, 2009). The three-item planning scale is developed based on concepts proposed by Bishop et al. (2007) and scale proposed by Gibson and

Birkinshaw (2004). The scale consists of these items: (1) we explore a variety of potential strategies and options to achieve the long term objectives; (2) our company puts emphasis on development of activity plans that optimise progress toward the organisational strategy; (4) our company applies rigorous measurement of business performance against goals and objectives.

Integrating capabilities

The second order formative construct of *integrating capabilities* is formed of three variables: (1) leadership; (2) coordination; (3) knowledge base.

Leadership. Previous research has indicated the importance of leadership and top management support in achieving organisational foresight and encouraging peripheral vision (e.g. Rohrbeck, 2010; Day and Shoemaker, 2005). Leadership is defined as the degree to which senior management fosters the organisational culture open to wider vision. To operationalise leadership, a scale was developed using three items proposed by Gibson and Birkinshaw (2004) and Rohrbeck (2010), focusing on leadership qualities such as 'willingness to test and challenge basic assumptions' or 'incentives to reward wider vision'.

Coordination. Effective incorporation of new knowledge requires effective coordination processes. Coordination is defined as the capacity of formal and informal communication, which describes the role and effectiveness of communication in the diffusion of information and future insights (based on Rohrbeck, 2010). To operationalise coordination, a scale was developed using three items from the scales proposed by Rohrbeck (2010): (1) 'every employee is expected to build and maintain formal and informal networks to other units'; (2) 'in our company, information is shared freely across functions and hierarchical levels'; (3) 'the activities of the different departments are well coordinated'.

Knowledge base. Knowledge is embedded in individuals as specific skills or in fixed capital which are used in the production process (Maskel and Malmberg, 1999). In this research knowledge base is defined as the stock of knowledge accumulated within the organisation, embodied by skilled human resources and accrued through in-house learning efforts (Guliani and Bell, 2005). In-house R&D activities and highly educated personnel are often perceived as the most effective ways to absorb external knowledge, thus, are often used as a measure of absorptive capacity (e.g. Oerlemans and Meeus, 2005). However, few companies in Lithuania have a separate R&D

department or formally trained technicians/scientists. Skills are usually developed through job training and practical experience. That means the longer they work the more skill they obtain. Therefore, experience has been included as it represents the cognitive background of each of the abovementioned resources in temporal terms. Knowledge base is measured using four items, two of them based on the scales proposed by Delgado (2011) and Dobni (2008): (1) estimate on the percentage of employees who hold a Master's or Doctor's degree; (2) estimate of the percentage of employees having at least 5 years of work experience in the industry sector where the company operates; (3) average of R&D expenditures with respect to sales; (4) whether continued organisational learning is encouraged and there is time/opportunity to improve skills and capabilities.

Ambidexterity

The second order formative construct of *ambidexterity* is formed of two variables: (1) explorative (radical) innovation; (2) exploitative (incremental) innovation. Ambidexterity is defined as the ability to pursue both explorative as well as exploitative innovation (Jansen, 2005). Explorative innovation is defined as innovation directed at new and emerging customers or based on radically new technologies (Benner and Tushman, 2003; Jansen, Van Den Bosch, and Volberda, 2006). Exploitative innovation is defined as innovation that is designed to meet the needs of existing customers or markets, based on refining and improving an existing technology or incremental change - a small change or a reconfiguration of an established system to link together existing components in a new way (Jansen et al., 2005). To test the constructs for explorative and exploitative innovation, the items are used as developed by Jansen et al. (2005) and applied by several other studies (e.g. Jansen, van den Bosch et al. 2006; Jansen, Tempelaar et al. 2009; Middelbeek, 2010). Exploration is measured with five items. Two examples are: 'we invent new products and services', 'we regularly search for and approach new clients in new markets'. Exploitation is measured with four items. Two examples are: 'we regularly implement small adaptations to existing products and services'; 'we improve our provision's efficiency of products and services'.

Control variables

In the research model we control for enterprise size and age. *Size* of the enterprise is defined by the number of employees including the owner. Enterprise size (i.e. small vs medium and large sized enterprises) may be a proxy for the internal capabilities, implying that size is associated with innovation behaviour. Size is found to correlate innovation capacity in several previous empirical studies, although the results are so far inconclusive. Both large enterprises and SMEs have comparative advantages and disadvantages with respect to product innovation. Advantages in the large enterprises are mainly material, while SME advantages are mainly behavioural (Rothwell and Dodgson, 1994). Some researchers state that large enterprises are proportionally more innovative than SMEs. Most arguments for this proposition are based on the 'technology push' concept, meaning that innovation is initiated by new technology, based on R&D. R&D activities have economies of scale (Kamien and Schwartz, 1982). Small R&D groups offer little opportunity for specialisation and are unable to efficiently exploit special equipment. Furthermore, increasing expenses for innovation in the present economy put SMEs in an unfavourable position (Kamien and Schwartz 1982). At the same time, SMEs may have more opportunities under the 'market pull' hypothesis since they are closer to their customers and they are more flexible. Nevertheless, SMEs have the opportunity to fill product and market niches, they develop new markets, and fulfil customised orders because they are less bureaucratic and therefore able to react more swiftly to environmental changes. The innovation activity of small and medium enterprises is not necessarily hindered by their size, as some studies reported that they experience lower market failures (Cefis and Marsili, 2003) and better rates of innovation than their larger counterparts (Chakrabarti, 1991). However, often SMEs are users of technology already invented and not creators of new technology (Bessant 1999). The acquisition of external knowledge may be an important source for innovation for SMEs. Also, SMEs may have a bigger role in imitative innovation (Eden et al. 1997). Rothwell (1987) argues that, although fundamental or radical invention ordinarily takes place within either large enterprises or large public laboratories, SMEs are disproportionately responsible for near-to-market developments and initial market diffusion. It can be presumed that innovation in an SME in a country with relatively new market economy context as Lithuania is largely an adoption of a product, process or method that have already been developed elsewhere. Enterprise *age* is important to the model given that the dependent variable

is ambidexterity (explorative and exploitative innovation) in the last three years prior to the survey. We therefore, only involve the small and medium sized enterprises established at least 3 years before the survey, i.e. April 2010.

The extent to which companies apply organisational foresight may also vary with industry types. As for industry types, we anticipate that there will be differences between high – medium high and low – medium low technology industries. In addition, the velocity of the firm's environment may influence the effects of foresight capabilities on innovation, and therefore organisational ambidexterity (Day and Schoemaker, 2005; Rohrbeck, 2010). A three-item measure is adapted from Jaworski and Kohli (1993) to operationalise *technological turbulence*. Technological turbulence is defined as the degree of change associated with product and process technologies in the industry in which a firm is embedded (Hanvanich et al, 2006). Also, in the Lithuanian context, extent to which companies are productive in innovation may also vary with *access to financial funds* in support of innovation.

However, previous research (e.g. Spector and Brannick, 2011) has suggested that control variables are often not uncontroversial. Researchers tend to focus on establishing relationships among large numbers of variables rather than attempting to understand the underlying processes involved. Much of this tendency is undoubtedly driven by the relative ease in establishing relationships and difficulties in establishing processes, but much of it is also due to the norms that have arisen in how research is done. In response to this argument, this study questions the effect of the variables above on the strength of both organisational foresight and organisational ambidexterity, and tests if there are differences among different groups of companies, based on their size, sector where they operate, access to financial funds and technological turbulence.

4.2.2. Reliability and validity

Face validation of the English questionnaire. A face validation procedure was conducted with two academics familiar with research on organisational foresight and scale development techniques to discuss the appropriateness of these new measurement items.

Translating instrument from English to Lithuanian. The instrument adopted in this study was originally developed in English. However, all potential participants in the

research are Lithuanian. Thus, it was necessary to conduct an English-to-Lithuanian translation before the field study. Therefore English-to-Lithuanian and back translations of the questionnaire with the statements and the guidelines were undertaken carefully to ensure that the linguistic validation is done appropriately. Because no Lithuanian version was identified for any of the used instruments, the researcher conducted the first-round translation of the items used from the instruments applied from Danneels (2005), Jansen et al. (2005), Rohrbeck (2010) and other scholars, and proposed by the researcher. Once the initial translation was completed, the Lithuanian version of the questionnaire was forwarded to a Lithuanian-English bilingual who is also quantitative survey expert. He examined the Lithuanian draft by comparing it to the English version and suggested a number of revisions for improving the second-round translation.

The second Lithuanian draft was forwarded to a professional translator to translate the instrument back into English. The original and back-translated English versions were compared by the researcher and the advisor. Finally, the third Lithuanian version of the questionnaire was prepared based on settling the differences between the previous two versions, resolving problematic items.

Pre-testing – 'think aloud' interviews and pilot study. According to Hulin and Mayer (1986), even if a translated version from one language to another achieves linguistic equivalence, it does not mean that the translated items have cultural and psychometric equivalence. Thus, a 'think-aloud' interviews and pilot study were conducted to establish cross-cultural sensitivity and to finalize the questionnaire before it is used. After the instrument was translated, two Lithuanian company managers were invited to think aloud on the clarity of the statements and to suggest improvements to the questionnaire. One company manager of a younger generation (aged 32) from a high technology company was interviewed, and one company manager aged 56 from a traditional sector (food industry) was interviewed. The 'think-aloud' questions were applied: 'Tell me what you are thinking about the content and statements of the questionnaire as you read it? Are they clear and easy to understand, or are they ambiguous and confusing?' The interviewees confirmed the instrument to be an effective and valid measure in Lithuanian settings. As well they offered recommendations on improvement of the questionnaire. Based on these recommendations, explanations next to some of the questions were provided in the questionnaire.

For the pilot study, 60 samples were selected from the target population by using simple random sampling (all contacts in the contacts list were given numbers, and every fifth was contacted). These respondents were contacted by phone and asked to complete the third version of the Lithuanian questionnaire and to comment on any problems they had. Thirty company managers agreed to participate in the pilot study. Three of the completed questionnaires were incomplete, so the pilot study yielded 27 responses (47 percent of the contacted sample). After revising the errors of the third Lithuanian draft based on the results of the pilot test and after checking the preliminary reliability of the scales, the questionnaire was finalised. Some items were dropped, and the final version of the survey was conducted immediately after the conclusion of the pilot study. The questions were randomly distributed (asked at random order) when carrying the phone survey.

4.2.3. The questionnaire

Table 9 summarises the contents of the instrument. The first three sections include the scales developed on the basis of instruments or concepts proposed by other researchers. The fourth section includes the original scales of ambidexterity proposed by Jansen (2005). Their contents or subscales, item numbers, and total number for each content/subscale are illustrated in the table. The demographic information and control variables are the fifth section in the table. The survey questionnaires are provided in the Annex 1 and Annex 2 (however, the items in a questionnaire were randomly distributed when carrying out a survey, which is not represented in the questionnaires provided in the Annexes).

Table 9. Constructs and items in the research instrument

Second-order capabilities	Definition	First-order capabilities	Definition	Total items	No. of item / Items	Sources
Environmental scanning capabilities	The extent to which a company deploys strong and weak tie external sources of information covering a stretch of time horizon from near to long term future, which facilitates market and technological opportunity recognition.	Strong tie sources	Exploiting sources of information with which companies typically have many social acquaintances in their everyday work and/or which generate familiar information.	5	A1. We participate in trade shows.	Based on Danneels, 2008
					A2. We read specialized journals and magazines to keep abreast of market and technical trends (removed after exploratory factor analysis)	
					A3. We conduct Internet and media research (removed after exploratory factor analysis)	Based on Rohrbeck, 2009
					A4. Employees of my company work jointly with suppliers in order to develop solutions.	Delgado, 2011
					A5. Employees of my company work jointly with customers to develop solutions.	
		Weak tie sources	Exploiting external sources of information with which the companies typically have little contact, but they can nevertheless provide conceptually new information (Ansoff, 1975; Hansen, 1999).	5	B1. We participate in professional association activities (removed after exploratory factor analysis)	Based on Danneels, 2008
					B2. We attend scientific conferences.	
					B3. We have an active network of contacts with the scientific and research community.	
					B4. We collect information on patents.	Based on Rohrbeck, 2009
					B5. We survey experts on their opinions, for example by using questionnaires, panels, focus groups, workshops, interviews, one to one meetings.	
		Time horizon	The time scale of environmental scanning focused on different time horizons – from short term (up to one year) to long term (up to more than 15 years in the future) (based on Rohrbeck, 2010).	4	C1. How much of the future conditions that you consider are less than 2 years in the future?	Based on Amsteus, 2011; Rohrbeck, 2010
					C2. How much of the future conditions that you consider are from 2 to 5 years in the future?	
					C3. How much of the future conditions that you consider are more than 5 years in the future?	
					C4. How much of the future conditions that you consider are at least 15 years in the future? (removed after exploratory factor analysis)	

Second-order capabilities	Definition	First-order capabilities	Definition	Total items	No. of item / Items	Sources
		Depth of scanning	Focusing on wide scope of environmental scanning, including the areas that currently seem to have no relevance to the company but which could breed disruptive changes that are difficult to perceive and to prepare for (Rohrbeck, 2010).	3	D1. We are scanning in all areas (technological, political, competitor, customer and socio-cultural environment).	Based on Rohrbeck, 2010
					D2. We also scan for developments in the markets and/or industries that we are not currently involved in.	
					D3. We also consider new issues, trends and technologies whose relevance to our business cannot yet be assessed.	
Strategic selection capabilities	The organisational routines comprised of analysing, visioning and planning, all determined to identify and sustain the preferred alternative for organisational change (based on Zott, 2003).	Analysing	Interpreting the collected data on future conditions and describing baseline and alternative futures: drivers and uncertainties, implications and outcomes (based on Bishop and Hines, 2007)	4	E1. In our company, we analyse in detail the potential future conditions.	Based on Amsteus, 2011
					E2. We forecast the potential future conditions.	Based on Bishop et al., 2007
					E3. We use modelling for analysing future conditions (e.g. econometric modelling, simulation or systems models / systems analysis).	
					E4. We use scenarios to describe potential futures.	
		Visioning	Choosing a preferred vision of the company's future: envisioning the best outcomes, goal-setting, performance measures (based on Bishop and Hines, 2007).	4	F1. We have a systematic vision development process.	Based on Bishop et al.2007
					F2. We apply visioning methods, for example balanced scorecard, appreciation inquiry, road-mapping.	
					F3. Our company sets long term objectives that are consistent with its vision and values.	Gibson and Birkinshaw, 2004
					F4. There is total agreement on our organisational vision across all levels, functions and divisions.	Sinkula et al., 1997

Second-order capabilities	Definition	First-order capabilities	Definition	Total items	No. of item / Items	Sources
		Planning	Deployment of organisational routines ensuring that the company's actions, skills, and processes support the long term organisational vision (Grim, 2009).	3	G1. Our company develops activity plans that optimize progress toward the organisational strategy. G2. We explore a variety of potential options to achieve the long term objectives. (Removed after exploratory factor analysis)	Based on Bishop et al., 2007
					G3. Our company applies rigorous measurement of business performance against goals and objectives.	Gibson and Birkinshaw, 2004
Integrating capabilities	The organisational leadership and coordination capabilities as well as the existing knowledge base, required to create and capture value from opportunities (based on Teece, 2007).	Leadership	The degree to which senior management fosters the organisational culture open to wider vision.	3	H1. Basic assumptions on the future of the company are explicit, much talked about and frequently challenged by the top management (Removed after exploratory factor analysis)	Rohrbeck, 2010
					H2. There are regular incentives for wider vision (recognition by senior management and/or financial rewards).	
					H3. Bringing external information into the company is encouraged by top management.	
		Coordination	The capacity of formal and informal communication, which describes the role and effectiveness of communication in the diffusion of future insights (Rohrbeck, 2010)	3	I1. The activities of the different departments are well coordinated.	Rohrbeck, 2010
					I2. Every employee is expected to build and maintain formal and informal networks to other units.	
					I3. In our company, information is shared freely across functions and hierarchical levels.	
		Knowledge base	The stock of knowledge accumulated within the organisation, embodied by skilled human resources and accrued through in-house learning efforts (Guliani and Bell, 2005).	4	K1. Our average annual R&D expenditures with respect to sales is one of highest in the industry.	Delgado, 2011
					K2. The percentage of our employees, who hold a Master's or Doctor's degree, is ...	Author
					K3. Continued organisational learning is encouraged and there is time/opportunity to improve skills and capabilities.	Dobni, 2008
					K4. The percentage of our employees having at least 5 years of work experience in our industry sector is ... (removed after reliability analysis)	

Second-order capabilities	Definition	First-order capabilities	Definition	Total items	No. of item / Items	Sources
Ambidexterity	The ability to pursue both explorative as well as exploitative innovation (Jansen, 2005).	Explorative innovation	Innovation directed at new and emerging customers or based on radically new technologies (Benner and Tushman, 2003; Jansen et al., 2006).	5	L1. We invent new products and services. L2. We commercialize products and services that are completely new to our company. L3. We frequently utilize new opportunities in new markets. L4. Our company regularly uses new distribution channels. L5. We regularly search for and approach new clients in new markets.	Jansen, 2005
		Exploitative innovation	Innovation that is designed to meet the needs of existing customers or markets, based on refining and improving an existing technology or incremental change - a small change or a reconfiguration of an established system to link together existing components in a new way (Jansen, 2005).	4	M1. We frequently refine the precision of existing products and services. M2. We regularly implement small adaptations to existing products and services. M3. We improve our provision's efficiency of products and services. M4. We introduce improved, but existing products and services for our local market. (Removed after exploratory factor analysis)	Jansen et al., 2005
Demographic characteristics / control variables		Technological turbulence	The degree of change associated with product and process technologies in the industry in which a firm is embedded (Hanvanich et al, 2006)	4	N1. The technology affecting our industry is changing rapidly. N2. Technological changes provide big opportunities in our industry. N3. A large number of new product ideas have been made possible through technological breakthroughs in our industry.	Jaworski and Kohli, 1993
		Access to funds		1	R. During the period from 2005 to 2010, did your firm receive any external funds for innovation activities, for example: governmental loans or grants, bank loans, venture capital?	

4.3. RESEARCH SAMPLE

This sub-chapter provides a brief description of the research setting and sample.

4.3.1. Arguments for Lithuanian manufacturing industry as a research setting

The research setting is the manufacturing industry in Lithuania. Manufacturing is an attractive sector for this study for a number of reasons. According to Rohrbeck (2010), first, enterprises in manufacturing are challenged to perpetually present their clients with breakthrough solutions; change and foresight-fullness are, therefore, inevitably part of their service and product offering. Second, this industry, especially the larger companies, high technology companies and those that are faced with industry clock-speed (Rohrbeck, 2010) embrace the challenges of not only developing but also sustaining foresight. These enterprises need to constantly 'stay ahead of the game' of product, process and technology innovation. The pressure is not only to foresee the future but often to define it. Thirdly, according to Schuz-Montag et al (2010), companies in the manufacturing sector have a longer tradition and a more advanced approach to systematic future-oriented work than service or retail enterprises.

The Lithuanian manufacturing sector is currently faced with an increasing need for restructuring that requires foresight knowledge. This need stems from the long term global challenges as well as from existing structure of Lithuanian industry and the prevailing competitiveness strategy still dependent on low costs. This strategy is losing its competitive edge very fast due to the following challenges (Paliokaitė and Martinaitis et al., 2013):

- First, Lithuanian manufacturing companies are faced with aggressive competition in the global business environment, in particular, the 'new economies' (China, India, Korea, Brazil etc.) that along with rapid changes in technologies is putting under pressure both industries which compete through low costs and manufacturers employing new technologies in developed countries.
- Second, depletion of mineral resources, energy resources etc. and rising costs of key production factors (energy, raw materials and – increasingly - labour resources) increases the need for both enhanced business productivity and moving towards production of higher value added products.

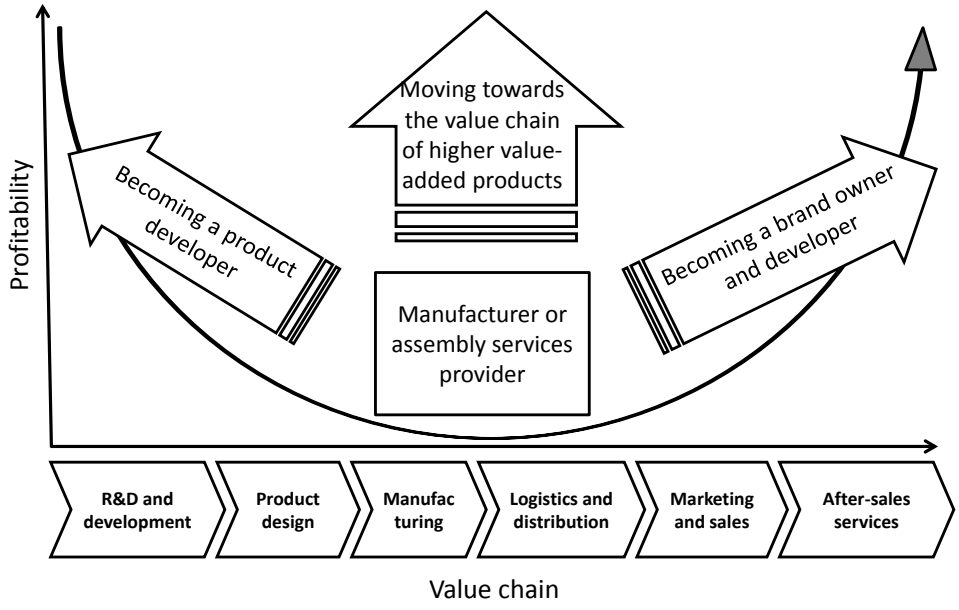
- Third, the lack of resources is a catalyst of a science-based radical innovation breakthrough at a global scale. Discoveries and technological development in such fields as materials science (new materials), information technologies, bio- and nanotechnologies as well as convergence of technologies, in particular in physics, chemistry and biology create opportunities for radical product and process innovations, open new niches for future production, change both the roles of the actors in the production chain and the geographical boundaries of the value chain. These changes create both opportunities (new technologies and products) and challenges (those who are the first to move towards new developments – win).
- Moreover, this creeping industrial revolution will change the present production standards and consumption habits of societies, and the increasing technological progress creates a strong need for new competences including the ones of flexible learning (learn, unlearn, relearn).

Despite these challenges, the growth experienced so far in Lithuanian industry cannot be considered as knowledge or innovation based. It has been driven by other more robust factors than research and innovation and business sophistication. The most prominent sectors in the Lithuanian industry are the traditional ones (like food industry) accounting for the largest share in value added, employment and leading in the Lithuanian exports. However, to sustain the competitiveness also in the future they face the need of upgrading. Despite, at present, export and competitiveness in Lithuania are highly dependent on these large sectors – the 'current locomotives' (Martinaitis et al., 2013), for the time being the majority of enterprises in these sectors are consumers rather than creators of innovation. At the same time, the innovation potential in the Lithuanian industry lies within emerging high technology sectors like biotechnology and pharmaceuticals, information technology manufacturing, and engineering industry (manufacturing of metals and machinery), which are still rather small with little to contribute to Lithuania's economy in terms of value added and employment. These 'rising/niche sectors' tend to earmark the largest amounts of research and innovation investments and tend to create and apply innovations most actively. These sectors can also be characterised as potential creators of innovation (Paliokaitė and Kubo, 2013; Paliokaitė et al., 2013a). The share of high-tech industry remains small also due to weak intersectoral integration, even though opportunities for this are provided by the introduction of advanced high technologies in traditional industries (Paliokaitė et al., 2013b).

Recession has forced Lithuanian industries to increase productivity, however, this was achieved by redundancies rather than through investments in modernisation of technologies or innovation. A large part of Lithuanian industries operate in the less profitable parts of the value added chain, i.e. they sell raw materials, assembly services or production capacities, or manufacture low value-added products. Specific challenges faced by Lithuanian industry today are: to increase productivity and efficiency of business processes in order to reduce costs; to increase the efficiency and synchronisation of the supply chain in order to achieve flexibility; to shift from mass production to mass customisation; to move to the more profitable parts of the value-added chain, by:

- Focusing on global markets: becoming a partner in international value chains, at least in terms of technology;
- Offering products with high value added, characterised by exceptional properties, tailor-made and based on new knowledge and technologies;
- Strengthening the branding process including product design (Paliokaitė and Martinaitis et al., 2013).

Figure 8. How to increase the value added in Lithuanian industry?



Source: Paliokaitė, 2013a, based on Estonian Development Fund (2009)

Hence, the above-described challenges inevitably make industries search for ways to predict or to form the new market needs, better integrate new technological

knowledge, quickly update the competences of the labour force, introduce new business models, and manage new production processes and systems. They also raise new expectations for high-quality management. Lithuanian industries have to become smart in the environment of higher production costs, aggressive competition and changing production technologies, i.e. in addition to applying knowledge and technologies in the development of new high-quality products, they must apply such production systems which would (i) be readily modernised by easy and effective integration of new technologies and functions; (ii) provide opportunities for quicker preparation of prototypes and placement of new products on the market (quick design, testing and manufacture); (iii) easily adapt to orders of different scope, manufacture of different products and niche needs (Paliokaitė et al., 2013b).

The current status quo of Lithuanian industry as described above made it a perfect research setting for testing the proposed conceptual framework on organisational foresight and organisational ambidexterity.

When it comes to innovation, the divide between high technology and low technology is important. It was assumed that the largest group (smaller companies operating in low technology sectors) may also be least innovative and having lowest organisational foresight capabilities. Thus, it was important that companies from other groups were well represented, otherwise the statistical results could describe the situation as worse that it is on average in Lithuanian industry. So the companies were grouped into 4 groups in order to have a good representativity of the different industry sectors (based on their R&D activity) and company sizes. Grouping was based on the Statistical Classification of Economic Activities in the European Community (NACE) at 3-digit level. NACE is the statistical classification of economic activities in the European Community, which imposes the use of the classification uniformly within all the Member States. It groups together the manufacturing industries, according to their technological intensity (R&D spending/value added), using the statistical data of the European Community (Eurostat). The level of R&D intensity serves as a criterion of classification of economic sectors into high-technology, medium high-technology, medium low-technology and low-technology industries. In some cases, due to restrictions of the data sources used, the aggregations are made at NACE 2-digit level. The sectors of the sample are listed in Table 10 below. The main type of industry is determined by the main type of company products or services (i.e. more than 50 percent of products).

Table 10. Industry sectors selected for the sample

Manufacturing industries	NACE Rev. 2 codes – 3-digit level
High – medium high technology	21 Manufacture of basic pharmaceutical products and pharmaceutical preparations 26 Manufacture of computer, electronic and optical products 20 Manufacture of chemicals and chemical products 25.4 Manufacture of weapons and ammunition 27 Manufacture of electrical equipment 28 Manufacture of machinery and equipment n.e.c. 29 Manufacture of motor vehicles, trailers and semi-trailers 30 Manufacture of other transport equipment 32.5 Manufacture of medical and dental instruments and supplies
Medium low – low technology	10 to 17 Manufacture of food products, beverages, tobacco products, textiles, wearing apparel, leather and related products, wood and of products of wood, paper and paper products 18 Printing and reproduction of recorded media 19 Manufacture of coke and refined petroleum products 22 Manufacture of rubber and plastic products 23 Manufacture of other non-metallic mineral products 24 Manufacture of basic metals 25 Manufacture of fabricated metal products, except machinery and equipment *excluding 25.4 Manufacture of weapons and ammunition* 31 Manufacture of furniture 30.1 Building of ships and boats 32 Other manufacturing *excluding 32.5 Manufacture of medical and dental instruments and supplies* 33 Repair and installation of machinery and equipment

Source: NACE Rev.2

The size of the enterprise in a sample was determined according to a number of employees. Only those enterprises that have more than 50 employees were selected for the study. The sample size was reduced in order to exclude the smallest enterprises where the managers' personal characteristics would have higher impact on enterprise performance (e.g. Lefebvre, et al. 1992, 1997) than the organisational capabilities defined in the conceptual model.

4.3.2. Sample size and sample justification

In an attempt to limit sample error and to delineate a population from which a reasonable sample could be drawn, the study was limited to stock enterprises in the manufacturing industry and their respective CEOs/product development managers. The sample was generated and further limited through a restrictive search in the enterprise database CREDITREFORM, based on the criteria of: i) enterprise activity according to NACE (manufacturing); ii) enterprise size (more than 50 employees); iii) enterprise establishment date (established at least 3 years prior to the date of survey).

Based on the company database CREDITREFORM, there were 778 companies meeting the selection criteria. The required sample size was 199 companies (confidence level 95%, confidence interval 6), which was selected using the proportionate stratified random sample method based on the size of the firm (50-250 employees vs larger than 250) and degree of technology (according to Table 10). Using a stratified sample has the advantage of greater precision compared to a simple random sample, provided that the strata have been chosen so that members of the same stratum are as similar as possible in terms of the characteristic of interest. The greater are the differences between strata, the greater is the gain in precision. A stratified random sampling when compared to simple random sampling guarantees better coverage of the population – control is achieved over the subgroups that are included in the sample, whereas simple random sampling does not guarantee than any one type of company will be included in the final sample (Castillo, 2009).

The sample size of each selected stratum in this study was proportionate to the population size of the stratum when viewed against the entire population - each stratum has the same sampling fraction (see Table 11 below). Each group had a separate contact list, which was used to call managers in random order.

Table 11. Stratified proportionate sample

Stratum	A Companies having 50-250 employees in high – medium high technology industries	B Companies having above 250 employees in high – medium high technology industries	C Companies having 50-250 employees in low – medium low technology industries	D Companies having above 250 employees in low – medium low technology industries	Total
Number of firms in Lithuanian industry per category	85	20	576	97	778
Percent of firms in Lithuanian industry per category	10%	2%	80%	8%	100%
Number of firms needed per category	20	4	159	16	199

Although it would appear that the key purpose of the survey in this case is to get as many filled questionnaires as possible, so that stratified sampling might appear to

be an excessive choice. However using a stratified sample helps avoiding a situation when a least performing group dominates the whole survey. In this case, it was suspected that the largest group in a population (group 3, consisting of smaller companies operating in low-medium low industries) is least innovative and faces lower need for foresight, as it may be operating in less volatile environment (e.g. less export oriented), implementing short-medium term focused strategies, etc. Therefore, control of the other three groups (groups 1, 2, and 4) that consist of either larger companies, or companies operating in high-medium high technology industries that were confirmed as having higher needs for foresight and innovation (e.g. Rohrbeck, 2010), allowed to balance the sample. The aim was to get as much replies as possible from each group (to ensure variation), but keeping the representativity close to the original structure of Lithuanian industry, so that the conclusions could be generalised. It was important that companies from other groups are well represented, otherwise the statistical results could describe the situation as worse that it is on average in Lithuanian industry.

This chapter discussed in detail the research design and presented how the measurement instrument was created. The next chapter presents and discusses the empirical research results.

5. EMPIRICAL RESEARCH RESULTS

An empirical approach with a questionnaire survey method was used in this research. This chapter describes the data collection procedures, the data analysis techniques used to answer the study's research questions and the results from the data analyses. The descriptive statistics for the scales are reported. The differences among demographic groups were determined with one-way ANOVA tests. The relations among organisational foresight capabilities and ambidextrous innovation (explorative and exploitative innovation) were explored with correlation and regression analysis. The statistical programmes SPSS 21.0 and Stata 12.0 were used to conduct the statistical analyses.

5.1. DATA COLLECTION AND DEMOGRAPHICS

The survey was carried out during March 25th - April 25th 2013. The questionnaire was divided into five sections, the first covering the environmental scanning capabilities of the firm, the second its strategic selection capabilities, the third it's integrating capabilities, the fourth its innovation behaviour and the last – the general features of the firm.

A sample of managers (CEOs and heads of product development or strategy departments) of stock enterprises in the manufacturing industries was invited to participate in a phone-based survey. Simple random sampling was applied - all contacts in the contacts list were given numbers, and an automated sample generator was applied in each separate stratum (see Tables 11 and 12). Each manager in a sample was contacted by telephone. Upon agreement to participate, each participant was read instructions and asked to complete the questionnaire. A total of 220 managers agreed to fill out a questionnaire. With the pilot study results the total response rate was 250 giving a response rate of 32 percent. Three of the pilot study responses were incomplete, and 17 of the main survey responses were incomplete. Together with the incorporated pilot study results, the research study gathered 230 completed questionnaires, giving a final response rate of 29.6 percent.

Table 12. Comparison of sample industries and sizes with the target population

	1 Companies having 50-250 employees in high – medium high technology industries	2 Companies having above 250 employees in high – medium high tech. industries	3 Companies having 50-250 employees in low – medium low tech. industries	4 Companies having above 250 employees in low – medium low technology industries	Total
Number of firms in Lithuanian industry	85	20	576	97	778
Percent of firms in Lithuanian industry	10%	2%	80%	8%	100%
Number of firms completing the survey	23	9	183	15	230
Proportion of firms (of total number of firms) completing the survey	10%	3.9%	79.6%	6.5%	100%

Table 12 presents the sample size and proportion of control groups in the final sample, which is fairly good except in section 2 (Companies having above 250 employees in high – medium high technology industries), where it is a little over-representative (3.9 percent vs. 2 percent), and section 4 (Companies having above 250 employees in low – medium low technology industries), where it is under-representative (6.5 percent vs. 8 percent). Overall, the survey response rate and control group representation were deemed acceptable.

5.2. MODEL RELIABILITY AND VALIDITY

5.2.1. Methodological choices and limitations

Novel measurements require reliability and validity. This sub-chapter discusses and provides justification to methodological steps taken to assess reliability and validity of the measurement instrument and the research model.

Measurements are *reliable* to the extent that they are repeatable and that any random influence which tends to make measurements different from occasion to occasion or circumstance to circumstance is a source of measurement error (Nunnally and Bernstein, 1994). Reliability can be estimated through four essential methods; the

retest method, alternative form method, split-halves method, and the internal consistency method (Nunnally and Bernstein, 1994). It has been suggested that the *retest* method, with some exceptions, generally should not be employed due to several problems (Amsteus, 2011). For example, a low coefficient does not necessarily mean low reliability; it may be that the underlying theoretical concept indeed has changed. The process of measuring can itself cause change in the underlying concept, or the respondents' memories with regard to the first test may influence the second ditto (Nunnally and Bernstein, 1994), inflating correlations between the two. The *alternate form* method entails that a different test is given at the second testing, while both tests are designed to measure the same phenomena (Amsteus, 2011). However, the second testing (either retest or alternate form) could not be applied in this dissertation due to resources limitations and because of the target group – managers are very busy people and it could be expected that the response rate would drastically fall if they would be tested for the second time. So it would have been both costly and unpractical. While the *split half* methods have some applications, they are generally outdated (Nunnally and Bernstein, 1994). The complete set can be split in numerous ways, and each may result in somewhat different reliability estimates (Amsteus, 2011).

In contrast to above approaches, estimates of *internal consistency* among the items require neither the splitting nor repeating of items, and the most common coefficient is Cronbach's alpha. It is considered the fundamental estimate of reliability (Nunnally and Bernstein, 1994). In this case, reflective indicators of a construct are to be internally consistent, and if equally reliable, interchangeable (Jarvis et al., 2003). Hence, reliability in the form of internal consistency such as Cronbach's alpha is appropriate as a criterion for appraising the adequacy of reflective models (Diamantopoulos and Siguaw, 2006). Consequently, in this dissertation, due to practical and economical constraints, the reliability of the organisational foresight's and ambidexterity's first-order scale (e.g. explorative innovation, weak tie sources) was assessed through Cronbach's alpha.

Now, the attention can be turned to *validity*, which deals with how well the measure measures what it is supposed to measure in the context in which it is to be applied (Nunnally and Bernstein, 1994). Nunnally and Bernstein (1994) have contended that there is essentially only one type of validity – *construct validity*, as there is no distinct border separating test content and construct, which is the extent to which a measure performs in accordance with its theoretical expectations (Carmines and

Zeller, 1979). Hence, it should be noted that strict discriminations among the validity forms (construct, content, predictive validity etc.) are impossible, and evidence collected relevant to one form is usually relevant also to the other forms (Amsteus, 2011). Based on the above, the present dissertation does not distinguish the forms of validity, and focuses on construct validity.

The assessment of validity frequently relies on expert judgments with regard to parts of the actual test and the defined domain (Nunnally and Bernstein, 1994). Some empirical techniques can also be employed. For example, internal consistency among the items (as discussed above) is due, and scores may be tested for correlation with scores on tests that are supposed to measure the same thing (Nunnally and Bernstein, 1994). Additionally, the indicator coefficients in structural equation modeling (SEM) represent the forthright structural relation between each indicator and latent variable and the strength of the Y's may be understood as validity coefficients (Diamantopoulos and Winklhofer, 2001). Face validity is also relevant, since it can be chiefly comprehended as demonstrating the degree to which a respondent, most often one who is not educated to assess evidence of validity, perceives that the test measures what it is intended to measure (Nunnally and Bernstein, 1994). It is not evidence of the usefulness of the measure, but can be important in terms of gaining approval of the test among users and their respondents (Nunnally and Bernstein, 1994).

To ensure construct validity, several methodological steps were performed. *First step,* stemming from literature analysis, was the specification of the domain of content and building an extant review of the concept helped to construct a measurement instrument covering key organisational foresight content domains (construct definition). *Second,* face validity measures from both the academics assessing the measurement instrument (is it measuring what it is supposed to measure) and potential respondents (are the questions understandable) further improved the content validity. *Third,* examination of internal consistency of the items using Cronbach's alpha yielded additional evidence of construct validity. *Fourth,* construct validity was examined using an exploratory factor analysis technique to determine that the factor structure is suitable. *Fifth,* confirmatory factor analysis was performed to a limited extent as discussed below.

Fourth and fifth steps involved assessment of the convergent and discriminant validity, i.e. the extent to which a latent variable discriminates from other latent variables. Discriminant validity means that a latent variable is able to account for more

variance in the observed variables associated with it than a) measurement error or similar external, unmeasured influences; or b) other constructs within the conceptual model. There are different methods to assess discriminant validity, for example, the multi-trait multi-method evaluation of constructs, comparisons of the shared variance (squared correlation) between each pair of constructs against the average of the AVEs (structural equation modelling, SEM) for these two constructs (Bove et al, 2009), exploratory (EFA) and confirmatory factor analysis (CFA) techniques that allow sorting separate items in a multi-dimensional construct according to their specific domain (the strength of the γs in the confirmatory factor analysis may be understood as validity coefficients), and other methods. The exploratory factor analysis with SPSS allowed assessment of the discriminant validity of the latent variables of first-order constructs. However, further validation with structural equation modelling techniques was limited due to the insufficient sample size. SEM is powerful when done with adequately large samples, and the larger the better. The recommended sample should allow from 10 to 20 observations or cases per measured item (parameter). Another issue related to sample size is the recommendation of having at least 3 manifest variables for each latent factor; with the suggestion of having 4 or more manifest variables for each latent factor (Anderson and Gerbing, 1988). Moreover, the more complex is the model (the more of manifest variables), the larger the sample should be, otherwise two persistence estimation problems likely to occur: non-convergence and improper solutions. SEM is based on covariances and covariances are less stable when estimated from small samples. Parameter estimates and chi-square tests of fit are also very sensitive to sample size (Ullman, 2006). Hence, SEM is a large sample technique and is in generally not recommended when the above-listed conditions are not met. Therefore, CFA with SEM and model fit tests were not performed on the full model, and were only applied to some parts of the model. Due to the limited sample the regression analysis with SPSS statistical package was also chosen instead of path analysis techniques with SEM (see next chapters). Therefore, it can be concluded that the validity assessment of organisational foresight construct is only partially completed and should be further tested with larger samples in future multi-method studies.

5.2.2. Preliminary scale reliability analysis

When assessing the reliability and validity of the constructs, it has to be beared whether the constructs are formative or reflexive. In our case, organisational foresight

is a third-order formative construct, formed of second-order formative constructs of environmental scanning, strategic selection and integrating capabilities, which on their own right are formed of reflexive scales. For formative constructs, indicators are explanatory, and the causal priority is from indicators (items) to construct. Omitting an indicator is omitting a part of the construct. Statistical assessment should be done at the construct level, but internal consistency and correlations between the constructs is not implied (Freeze and Raschke, 2007). Items of the first-order reflexive constructs (such as leadership, coordination, etc.) however should possess internal consistency and correlations should be high. Removal of an item does not change the essential nature of the underlying reflexive construct; hence, there should be a higher number of preliminary items for pre-testing.

In order to test the applicability of the Lithuanian questionnaire, the reliability of the instrument was examined with internal consistency using Cronbach's alpha (coefficient of reliability). Cronbach's alpha is a measure of the internal consistency of a test containing items that are not scored dichotomously. Hair et al. (1998) recommend that Cronbach alpha values from 0.6 to 0.7 are deemed as the lower limit of acceptability. An alpha of more than 0.7 would indicate that the items are homogeneous and measuring the same construct. However, according to Bowling (2002), Cronbach's alpha of 0.5 or higher is considered as a sign of acceptable internal consistency.

Table 13. Internal consistency analysis using Cronbach's alpha

Scale	No. of items	Cronbach's alpha	Cronbach's alpha based on standardized items
Strong tie sources	5	0.621	0.631
Weak tie sources	5	0.663	0.663
Time horizon	4	0.767	0.771
Depth of scanning	3	0.749	0.748
Analysing	4	0.800	0.807
Visioning	3	0.830	0.834
Planning	3	0.853	0.853
Leadership	3	0.709	0.712
Coordination	3	0.800	0.800
Knowledge base	3	0.514	0.517
Explorative innovation	5	0.808	0.808
Exploitative innovation	4	0.720	0.739
Technological turbulence	3	0.745	0.746

Cronbach's alpha reliability scores for analysing, visioning, planning, coordination and explorative innovation were over 0.8, which is considered very good (Hair et al., 1998). Cronbach's alpha reliability scores for strong tie sources, weak tie sources, time horizon, depth of scanning, leadership, exploitative innovation and technological turbulence were between 0.621 and 0.767, which is considered good (see Table 13). Hence, the results demonstrate that the questionnaire can be considered an adequately reliable measurement instrument. Cronbach's alpha reliability score for knowledge base was between 0.5 and 0.6 (after removing one of the four items in a scale), which shows that the reliability of this scale is weak according to Hair et al (1998). However, reliability of this scale is close to the acceptable lower limit, so was not eliminated from further statistical analyses. The results demonstrate that the questionnaire could be considered an adequately reliable measurement instrument.

5.2.3. Exploratory factor analysis

Factor analysis provides an empirical basis for reducing all items to a few factors by combining variables that are moderately or highly correlated with each other (Gall, Gall, and Borg, 2007). Separate exploratory factor analyses (principal axis and varimax rotation) were performed on the organisational foresight (environmental scanning, strategic selection, integrating capabilities) and ambidexterity items in the preliminary scale.

The Kaiser-Meyer-Olkin (KMO) measures the sampling adequacy which should be greater than 0.5 for a satisfactory factor analysis to proceed (Hutcheson and Sofroniou, 1999). Looking at the table below, the KMO measure is 0.893. From the same table, we can see that the Bartlett's test of sphericity is significant.

Table 14. KMO and Bartlett's Test

Kaiser-Meyer-Olkin Measure of Sampling Adequacy.		.893
Bartlett's Test of Sphericity	Approx. Chi-Square	3369.842
	df	528
	Sig.	.000

In this study, based on factor analysis, the 32 items measuring organisational foresight were reduced to eight factors instead of ten anticipated factors. The 8 items of ambidexterity were reduced to two factors. Thus, it is possible to compute a correlation coefficient between a factor and an item that belonged to the factor. Gall, Gall, and Borg (2007) pointed out this correlation coefficient is called a factor loading.

Factor loadings of 0.50 or higher are considered practically significant. Variance explained by the eight organisational foresight factors was 62.2 percent. Variance explained by the two ambidexterity factors was 60.7 percent. Tables 15 and 16 demonstrate the factor loadings for the subscales of organisational foresight and ambidexterity in the study.

Eigenvalues, scree-plot, theoretical considerations and interpretability suggested four-factor solution for the environmental scanning items, all as expected. The pattern of factor loadings suggested two items for removal among the strong tie sources items, one item for removal among the weak tie sources items, and one item for removal among the time horizon items. Variance explained by the four environmental scanning factors was 53.3 percent.

Instead of three factors, a two-factor solution was suggested for the strategic selection items. The first factor explained the visioning and analysing items. The pattern of factor loadings suggested one items for removal among the visioning-planning items. Variance explained by the two strategic selection factors was 63.2 percent. Similarly, a two-factor solution was suggested for the integrating capabilities items, instead of theoretical three factors. The factor loading suggested that leadership and coordination items are explained by the same factor, and it suggested two items for removal from the leadership items. One item was suggested for removal from the knowledge base items. Variance explained by the two integrating capabilities factors was 51.2 percent.

Table 15. Results from first-order factor analysis on organisational foresight items

	Factor loadings	Cronbach's alpha	Variance explained	Eigen values
1. Time horizon (first factor, after coding)				
How much of the future conditions that you consider are less than 2 years in the future?	.615	0.725	66.647	1.994
How much of the future conditions that you consider are from 2 to 5 years in the future?	.863			
How much of the future conditions that you consider are more than 5 years in the future?	.768			
2. Depth of scanning (first factor)				
We are scanning in all areas (technological, political, competitor, customer and socio-cultural environment).	.625	0.749	66.644	1.999
We also scan for developments in the markets and/or industries that we are not currently involved in.	.827			
We also consider new issues, trends and technologies whose relevance to our business cannot yet be assessed.	.784			
3. Strong tie sources (first factor)				
We participate in trade shows.	.522	0.616	56.850	1.706

	Factor loadings	Cronbach's alpha	Variance explained	Eigen values
Employees of my company work jointly with customers to develop solutions.	.761			
Employees of my company work jointly with suppliers in order to develop solutions.	.777			
4. Weak tie sources (first factor)				
We attend scientific conferences.	.773	0.728	55.596	2.224
We collect information on patents.	.653			
We survey experts on their opinions, for example by using questionnaires, panels, focus groups, workshops, interviews, one to one meetings.	.591			
We have an active network of contacts with the scientific and research community.	.653			
5. Analysing				
In our company, we analyze in detail the potential future conditions.	.593	0.800	63.488	2.540
We forecast the potential future conditions.	.523			
We use modelling for analysing future conditions (e.g. econometric modelling, simulation or systems models / systems analysis).	.752			
We use scenarios to describe potential futures.	.517			
6. Visioning and Planning				
We have a systematic vision development process.	.664	0.873	61.863	3.712
We apply visioning methods, for example balanced scorecard, appreciation inquiry, road-mapping.	.623			
Our company sets long term objectives that are consistent with its vision and values.	.762			
There is total agreement on our organisational vision across all levels, functions and divisions.	.715			
Our company develops activity plans that optimize progress toward the organisational strategy.	.605			
Our company applies rigorous measurement of business performance against goals and objectives.	.506			
7. Leadership and Coordination (first factor)				
There are regular incentives for wider vision (recognition by senior management and/or financial rewards).	.535	0.807	56.988	2.849
Bringing external information into the company is encouraged by top management.	.597			
The activities of the different departments are well coordinated.	.780			
Every employee is expected to build and maintain formal and informal networks to other units.	.765			
In our company, information is shared freely across functions and hierarchical levels.	.739			
8. Knowledge base (first factor)				
Our average annual R&D expenditures with respect to sales is one of highest in the industry.	.799	0.514	51.502	1.535
The percentage of our employees, who hold a Master's or Doctor's degree, is ...	.707			
Continued organisational learning is encouraged and there is time/opportunity to improve skills and capabilities.	.629			

Extraction Method: Principal Component Analysis.

Rotation Method: Varimax with Kaiser Normalization.

Factor loading are calculated for a unified factor analysis of organisational foresight factors. Variance and Eigen values calculated for each factor separately.

As expected, a two-factor solution was suggested for the ambidexterity items. The factor loading suggested one item for removal from the exploitative innovation items.

Table 16. Summary of result from factor analysis on organisational ambidexterity

	Factor 1 Explorative innovation	Factor 2 Exploitative innovation
We invent new products and services.	.667	
We commercialize products and services that are completely new to our company.	.616	
We frequently utilize new opportunities in new markets.	.846	
Our company regularly uses new distribution channels.	.737	
We regularly search for and approach new clients in new markets.	.668	
We frequently refine the precision of existing products and services.		.765
We regularly implement small adaptations to existing products and services.		.825
We improve our provision's efficiency of products and services.		.718
Cronbach's alpha	0.808	0.735

From the factor analysis results in Tables 15-16, the study found that the loadings of the measure on each factor in the three scales exceeded the minimum of 0.6. The scales of Coordination and Leadership were merged into one scale called Coordination, which is acceptable given the theoretical considerations (leadership can mean good communication / coordination of organisation's mission and values). The scales of Visioning and Planning were merged into one scale called Visioning, which is also acceptable given the theoretical considerations (meaning that planning helps incorporating vision into organisation's strategy and helps measuring how good are the activities in implementing organisation's vision). The factor analysis verified the scales of Weak tie sources, Strong tie sources, Time horizon, Depth of scanning, Analysing, Visioning, Coordination and Knowledge base to be the appropriate factors for the research. All theoretical dimensions of organisational foresight capabilities and ambidextrous innovation were represented by 3-6 items. The Cronbach's alphas for all scales are above 0.5 (ranging from 0.514 to 0.873), hence are considered acceptable (Bowling, 2002). The factors were labelled accordingly, as presented in Tables 15 and 16.

Second-order factor analysis. Second-order models are potentially applicable when (a) the lower order factors are substantially correlated with each other, and (b) there is a higher order factor that is hypothesized to account for the relations among the lower order factors. A second-order factor model has several potential advantages over a first-order factor model. It can test whether the hypothesized higher order factor

actually accounts for the pattern of relations between the first-order factors. In order to perform the second-order factor analysis, the Kaiser-Meyer-Olkin (KMO) and Bartlett's tests were performed. The KMO measure of 0.328 implied that the second-order factor analysis is not appropriate for this research.

5.2.4. Confirmatory factor analysis

As discussed in sub-chapter 5.3.1, there were three limitations that precluded the confirmatory factor analysis and the model fit assessment:

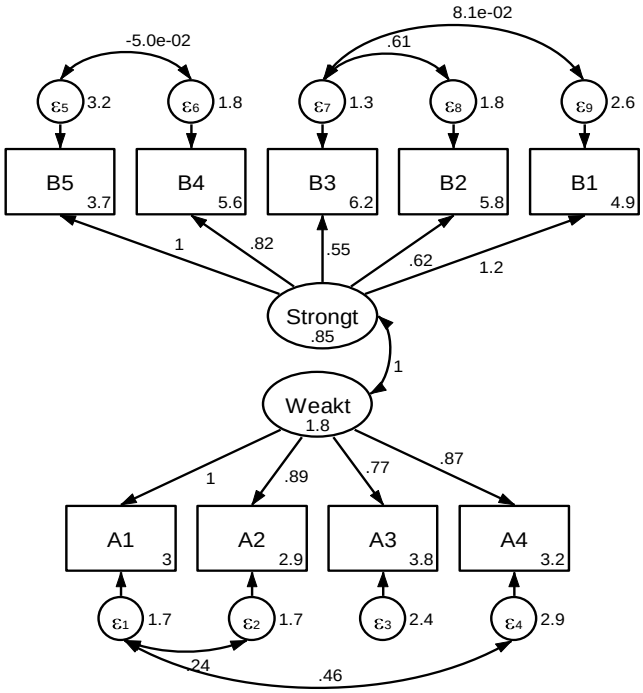
- First, insufficient sample size did not allow the assessment of CFA and model fit for the full model. Therefore CFA was performed on separate parts of the model.
- Second, SEM requires at least three variables (better – more) per latent variable. Since EFA showed that Strategic selection and Integrating capabilities each consist of two variables (Analysing and Visioning, and Coordination and Knowledge base), SEM techniques for these second-order factors could not be performed.

Several indices were taken into account when performing SEM analysis with Stata 12.0 statistical package: chi square, comparative fix index (CFI) and root mean square error of approximation (RMSEA). A chi square probability value greater than .05 indicates acceptable model fit – a non-significant chi-square indicates that the predicted model is congruent with the observed data. The higher the probability level (p value) associated with chi square, the better the fit. If model chi-square < .05, the model is rejected. The smaller the Chi-square, the better the fit of the model. The fit is considered better the closer the Chi-square value is to the degrees of freedom for a model (Thacker, Fields and Tetrick, 1989). CFI (comparative fix index), close to 1 indicates a very good fit, > 0.9 or close to 0.95 indicates good fit. By convention, CFI should be equal to or greater than .90 to accept the model. A model is considered well-fitted if RMSEA is less than or equal to .05. Some also suggest that there is adequate fit if RMSEA is less than or equal to .08, and even RMSEA up to .10 is acceptable. Hence, in this dissertation RMSEA less than .05 indicates good fit, 0.0 indicates exact fit, from .05 to 0.08 indicates fair fit, from .08 to .10 indicates mediocre fit, greater than .10 indicates poor fit.

Environmental scanning. First, CFA was performed on the factors of *Weak tie sources and Strong tie sources* (see Figure 9). The post-hoc modifications were applied to achieve the best fit. B3 and B2 items were removed, confirming EFA results which suggested removal of two items. The fit statistics for this model (chi square

27.67; 21 degrees of freedom; p value 0.1499; RMSEA 0.037; CFI 0.984) with 95 percent confidence interval indicated a good fit. Several warning signs could be indicated when assessing the results. First, although the items loadings on the factor were acceptable, high covariance was indicated between both factors. Secondly, factor loadings of items B2 and B3 on the variable Strong tie sources, were much lower than of items B1, B4 and B5.

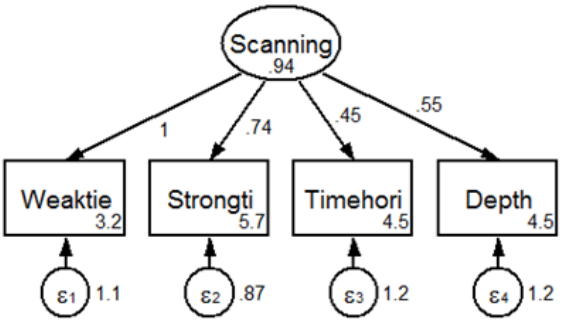
Figure 9. CFA Weak tie sources and Strong tie sources



CFA attempts on Time horizon and Depth of scanning failed (the programme didn't generate any output). Since EFA loadings for these factors were acceptable, this study does not indicate a poor fit, but concludes that the validity assessment of these scales is not finished and could be attempted by future studies.

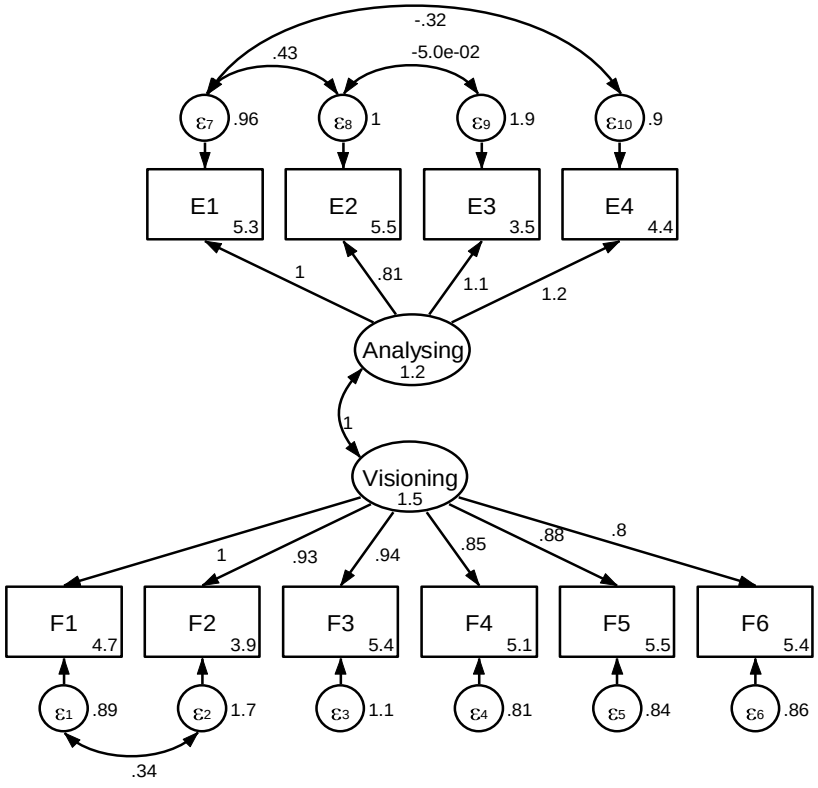
Next CFA for the second-order factor Environmental scanning was completed, using the average scores of separate items (indexes). The fit statistics indicated a mediocre but acceptable fit (chi square 4.95; 2 degrees of freedom; p value 0.0844; RMSEA 0.080; CFI 0.969). The analysis indicated somewhat lower loadings of Depth and Time horizon on Environmental scanning. All the coefficients were statistically significant (p = 0.000).

Figure 10. Environmental scanning



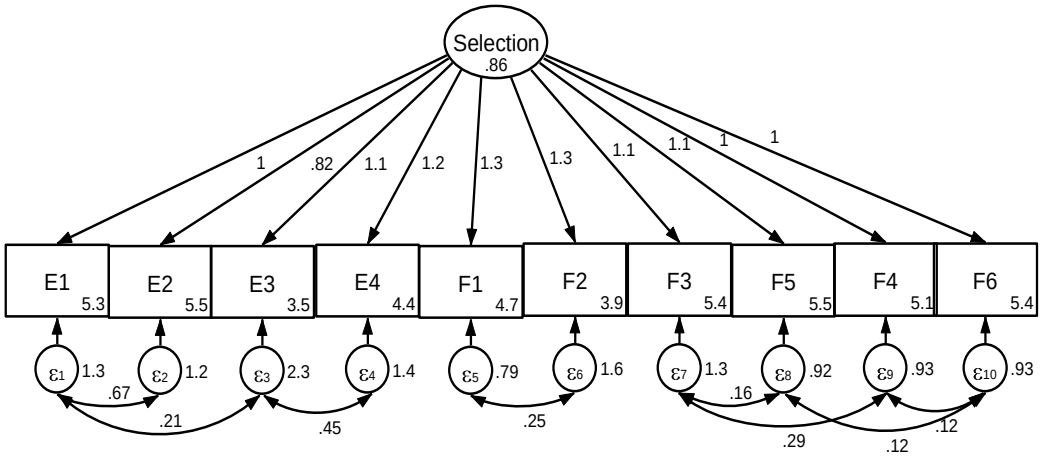
Strategic selection. CFA with post-hoc modifications was performed on the factors of Analysing and Visioning (see Figure 11). The fit statistics (chi square 29.64; 27 degrees of freedom; p value 0.3304; RMSEA 0.021; CFI 0.998) with 95 percent confidence interval indicated a good fit. The factor loadings were as expected in case of both Visioning and Analysing. The results also indicated high covariance between Analysing and Visioning.

Figure 11. CFA for Analysing and Visioning



Further it was tested how the items load on the second-order factor Strategic selection. Since CFA requires at least three manifest variables per latent variable, CFA with only two (Analysing and Visioning) latent variables was not possible. The fit statistics after post-hoc modifications with 95 percent confidence interval indicated a good fit with similar values (chi square 26.07; 23 degrees of freedom; p value 0.2975; RMSEA 0.024; CFI 0.997).

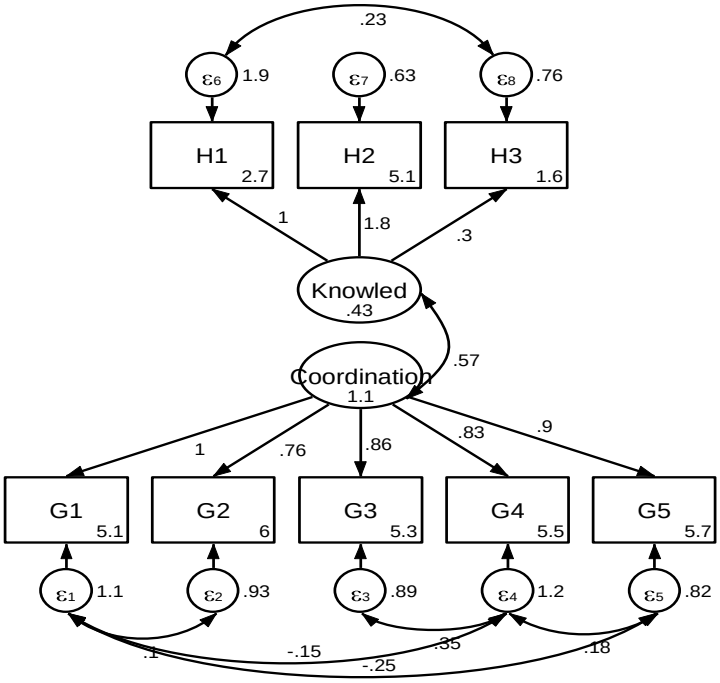
Figure 12. Strategic selection



Integrating capabilities. CFA with post-hoc modifications was performed on the factors of Coordination and Knowledge base (see Figure 13).

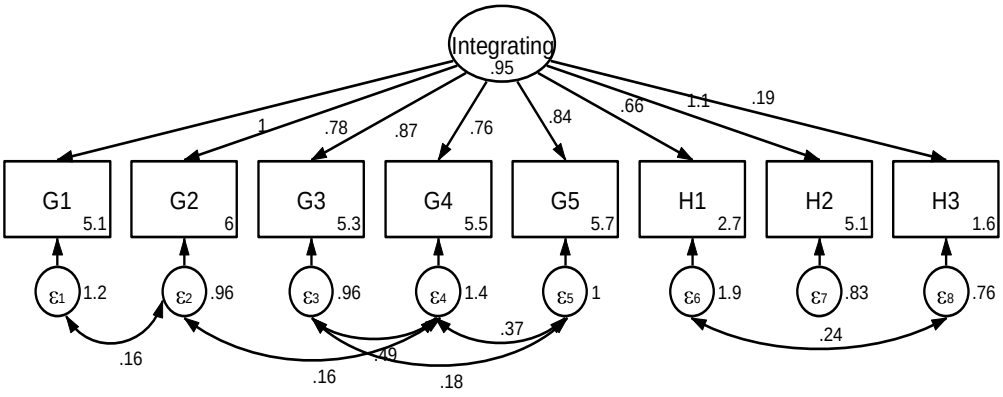
The fit statistics (chi square 14.40; 13 degrees of freedom; p value 0.3464; RMSEA 0.022; CFI 0.997) with 95 percent confidence interval indicated a good fit. The factor loadings were as expected in case of Coordination. However, the loadings for Knowledge base were worse than identified by EFA. The relatively low reliability (based on Cronbach's alpha) of the Knowledge base scale, together with the CFA results, indicates that, although the Knowledge base measure is theoretically well-grounded, it is probably not a scale, but a formative construct. Its validity could be further improved.

Figure 13. CFA for Coordination and Knowledge base



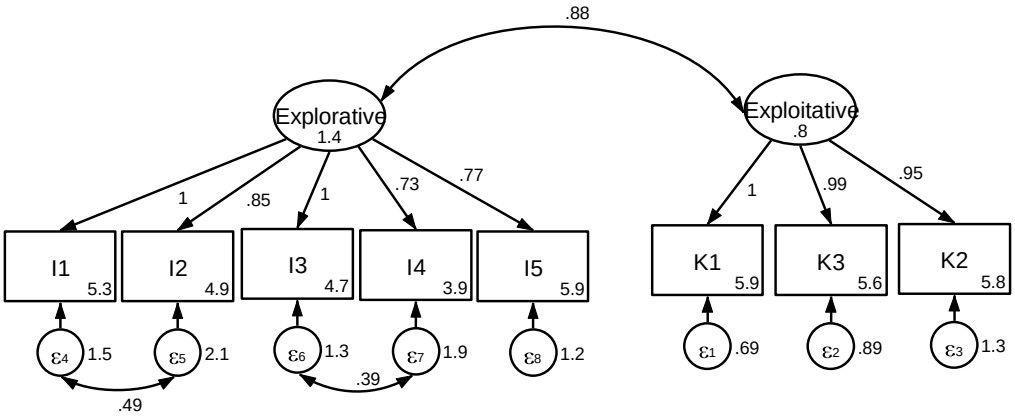
Further it was tested how the items load on the second-order factor Integrating capabilities. Since CFA requires at least three manifest variables per latent variable, CFA with Knowledge base and Coordination variables was not possible. The fit statistics after post-hoc modifications with 95 percent confidence interval indicated a good fit with similar values (chi square 15.44; 14 degrees of freedom; p value 0.3485; RMSEA 0.021; CFI 0.997). The factor loadings for item H3 suggest that it probably does not belong in this scale.

Figure 14. Integrating capabilities



Explorative and exploitative innovation. Two-factor CFA analysis for Explorative innovation and Exploitative innovation, after post-hoc modifications, showed a good fit (chi square 23.17; 17 degrees of freedom; p value 0.1439; RMSEA 0.040; CFI 0.987). CFA yielded high factor loadings for all observed variables (items) in case of both latent variables Explorative innovation and Exploitative innovation. A high covariance (0.88) was indicated between Explorative innovation and Exploitative innovation.

Figure 15. CFA for Explorative and Exploitative innovation



5.2.5. Conclusion and the final structural research model

The result of the factor analysis is satisfactory. The Cronbach alpha identified most scales as reliable (except Knowledge base). Exploratory factor analysis showed that items representing Weak tie sources, Strong tie sources, Depth, Time horizon, Analysing, Knowledge base, Explorative and Exploitative innovation loaded on one factor as theoretically anticipated. Although some scales were merged (Planning and Visioning making one Visioning scale; Leadership and Coordination making one Coordination scale) after their items loaded on the same factor, existing scales still can reflect most dimensions of organisational foresight as it was anticipated in the theoretical analysis.

Confirmatory factor analysis showed good fit statistics for the Weak tie sources, Strong tie sources, Analysing, Visioning and Coordination scales. Factor loadings of these scales showed sufficient variance. The scales of Depth and Time horizon were not tested with CFA, and the scale of Knowledge base showed poor factor loadings as expected. Further, the full third-order (three-level) organisational foresight construct

could not be tested with SEM because it did not meet two important conditions: sufficient sample and at least three manifest variables per latent factor (in case of Strategic selection and Integrating capabilities). However, the first-factor model indicating relationships between first-order factors and two dependent variables showed acceptable fit.

In summary, techniques employed ensured that:

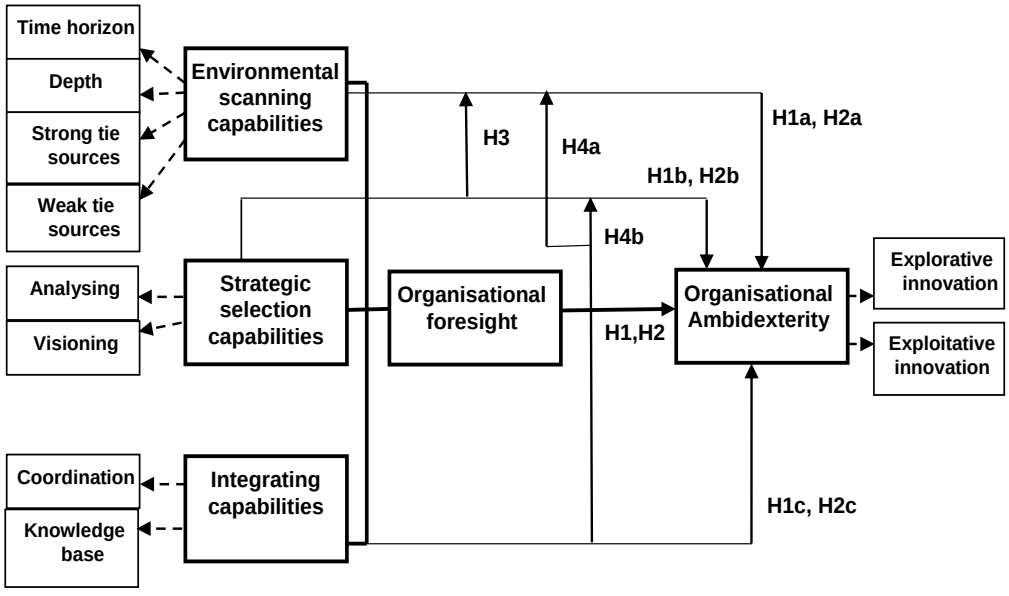
(a) The theoretical and observational meaningfulness of the concepts were met;

(b) Internal consistency of operationalisations was acceptable (except the reliability of Knowledge base scale could be further improved);

(c) Convergent validity was acceptable in case of seven out of ten scales (Depth and Time horizon should be further validated, and the scale of Knowledge base could be improved).

In summary, it can be concluded that the reliability and validity of the proposed first-order factor model can be deemed acceptable, but the validity assessment of some scales is only partially completed and should be further tested with larger samples in future multi-method studies. Without the scales which validation is only partially completed the organisational foresight construct would lose its theoretical meaningfullness. Hence, these scales were accepted for hypothesis testing. The final research model is presented by Figure 16 below.

Figure 16. Final structural research model



Next chapters present the statistics of organisational foresight and organisational ambidexterity in Lithuanian manufacturing companies, and the results of hypothesis tests.

5.3. FORESIGHT AND AMBIDEXTERITY IN MANUFACTURING COMPANIES

This chapter presents the data on the status quo of organisational foresight capabilities, explorative and exploitative innovation in Lithuanian manufacturing companies. It also discusses the differences in organisational foresight capabilities and organisational ambidexterity based on size of firm and sector where it operates, as well as technological turbulence and access to external financial aid for innovation.

5.3.1. Descriptive statistics in four company groups according to company size and industry type

230 managers of manufacturing companies registered at least three years prior to the survey in Lithuania, and having no less than 50 employees, participated in a survey. There were 40 questions in total asking participants about the organisational foresight capabilities of their company (32 items), and explorative (5 items) as well as exploitative innovation (3 items). In this section, means and standard deviations calculated from scales on organisational foresight dimensions and explorative as well as exploitative innovation are presented. Scores of the four items based on percentage scale were transformed to seven-point Likert-type scale. Table 17 shows the average scores of items in each of the scales according to the four company groups referring to each stratum in the sample.

Table 17. Descriptive statistics based on size of firm and sector where it operates

	Total		1		2		3		4	
	N=230		N=23		N=9		N=183		N=15	
	Mean	SD	Mean	SD	Mean	SD	Mean	SD	Mean	SD
Strong tie sources	**5.63**	1.24	**6.09**	1.13	**5.30**	1.15	**5.54**	1.27	**6.24**	.68
Weak tie sources	**3.20**	1.45	**4.23**	1.55	**3.47**	1.50	**2.98**	1.37	**4.15**	1.22
Time horizon	**4.24**	1.23	**4.57**	1.44	**4.04**	0.78	**4.43**	1.22	**4.47**	1.37
Depth of scanning	**4.45**	1.29	**4.68**	.92	**4.44**	.73	**4.40**	1.38	**4.67**	.96
Analysing	**4.64**	1.31	**4.61**	1.34	**4.75**	.89	**4.63**	1.35	**4.72**	1.19
Visioning	**4.99**	1.21	**5.39**	1.18	**5.17**	1.07	**4.89**	1.22	**5.41**	1.03
Coordination	**5.54**	1.05	**5.93**	.73	**5.40**	.98	**5.48**	1.08	**5.72**	.99
Knowledge base	**3.03**	0.93	**3.96**	1.07	**3.52**	0.40	**2.93**	0.88	**3.51**	1.00

	Total		1		2		3		4	
	N=230		N=23		N=9		N=183		N=15	
	Mean	SD	Mean	SD	Mean	SD	Mean	SD	Mean	SD
Organisational foresight index*	**4.52**	0.83	**4.94**	0.80	**4.58**	0.62	**4.43**	0.83	**4.85**	0.80
Exploitative innovation	**5.74**	1.16	**5.94**	.97	**6.07**	.83	**5.65**	1.21	**6.20**	
Explorative innovation	**4.82**	1.32	**4.96**	1.35	**4.80**	1.35	**4.74**	1.35	**5.57**	

1 - Companies having 50-250 employees in high – medium high technology industries

2 - Companies having above 250 employees in high – medium high technology industries

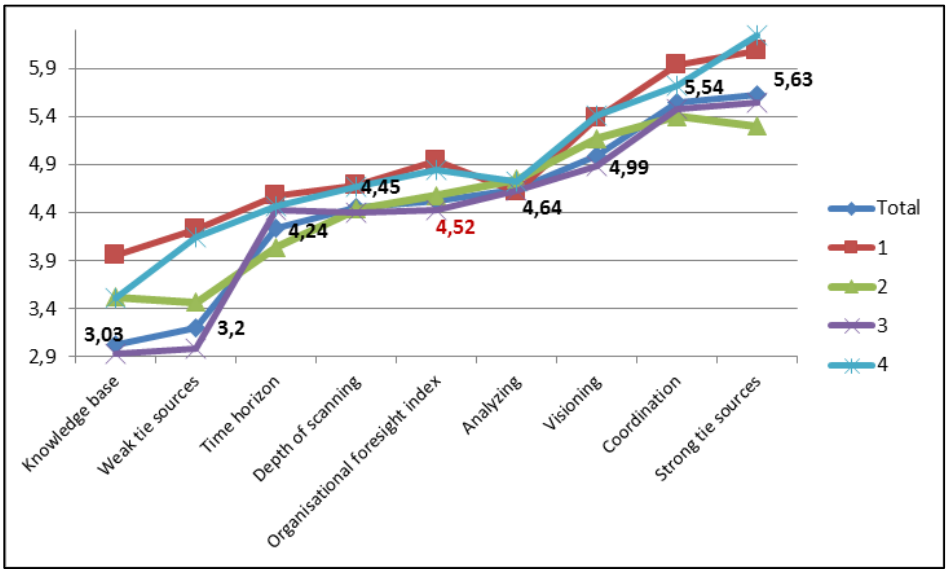
3 - Companies having 50-250 employees in low – medium low technology industries

4 - Companies having above 250 employees in low – medium low technology industries

* - Organisational foresight index is calculated by adding the average scores (means) of each of the eight dimension and dividing by the number of the dimensions.

Descriptive statistics presented in Table 17 and Figure 17 show that companies *having 50-250 employees and operating in high – medium high technology industries* have the highest degree of organisational foresight index (4.94, compared to the average of 4.52 in the overall group), followed by companies having above 250 employees and operating in low-medium low technology industries (4.85).

Figure 17. Organisational foresight capabilities based on size and sector



1 - Companies having 50-250 employees in high – medium high technology industries

2 - Companies having above 250 employees in high – medium high technology industries

3 - Companies having 50-250 employees in low – medium low technology industries

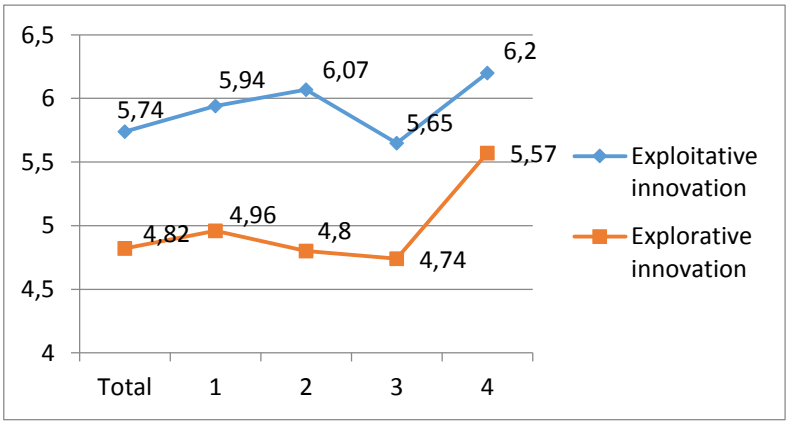
4 - Companies having above 250 employees in low – medium low technology industries

Total – total sample (scores marked by numbers)

The statistical significance of these differences were not examined due to very small samples of group 1 and group 2, hence these conclusions refer only to those companies that participated in a survey. The analysis of means also shows that environmental scanning in the Lithuanian manufacturing companies relies mostly on strong tie sources (mean = 5.63, N=230), when the average scores for using the weak tie sources such as researchers at the universities, patents and scientific conferences are low (mean =3.20, N=230). This can possibly be explained by relatively low score of the knowledge base (educated workforce, organisational learning and R&D expenditure), overall mean of 3.03 (at 7 point Likert-type scale).

Table 17 and Figure 18 show that larger companies are focused on exploitative (incremental) innovation more than smaller companies (up to 250 employees). Companies operating in high-medium high technology sectors are focused on explorative innovation more than those who operate in low – medium low technology sectors, although the score difference between group 2 (Companies having more than 250 employees and operating in high-medium high tech sectors) and group 3 (Companies having 50-250 employees and operating in low-medium low technology sectors) is not substantial. Overall, group 4 (Companies having more than 250 employees and operating in low-medium low technology sectors) scored highest in terms of both explorative and exploitative innovation.

Figure 18. Explorative and exploitative innovation based on size of firm and sector



1 - Companies having 50-250 employees in high – medium high technology industries
2 - Companies having above 250 employees in high – medium high technology industries
3 - Companies having 50-250 employees in low – medium low technology industries
4 - Companies having above 250 employees in low – medium low technology industries

Next sections investigate the statistical differences in organisational foresight capabilities and organisational ambidexterity based on (1) size of firm, (2) industry sector, (3) technological turbulence and (4) access to external financial aid for innovation.

Table 18. Tests of Normality

	Kolmogorov-Smirnov[a]			Shapiro-Wilk		
	Statistic	df	Sig.	Statistic	df	Sig.
Exploitative innovation	.160	230	.000	.885	230	.000
Explorative innovation	.121	230	.000	.948	230	.000
Analysing	.096	230	.000	.979	230	.001
Visioning	.079	230	.002	.972	230	.000
Strong tie sources	.144	230	.000	.884	230	.000
Weak tie sources	.082	230	.001	.963	230	.000
Coordination	.115	230	.000	.926	230	.000
Time horizon	.091	230	.000	.984	230	.009
Depth of scanning	.095	230	.000	.978	230	.001
Knowledge base	.105	230	.000	.973	230	.000

The results of Kolmogorov-Smirnov tests for normality (Table 18) indicated non-normal distribution of all the studied variables. Hence, non-parametric Mann-Whitney U test (Mann-Whitney-Wilcoxon test) was applied. This test evaluates whether the medians (mean ranks) on a test variable differ significantly between two groups. The means of the variables in the groups studied were calculated separately.

5.3.2. Does company size matter?

The data were split around the mean value of the number of employees (137) in a total sample, thus forming two groups: (1) group 1 ‘Smaller companies’ having from 50 to 137 employees, and (2) group 2 ‘Larger companies’ having above 137 employees. Comparisons of the means between these two groups (Annex 3) showed that ‘Larger companies’ in a sample had on average larger means for Weak tie sources, Strong tie sources, Depth of scanning, Visioning, Coordination, Knowledge base, as well as both Explorative and Exploitative innovation. Only the means of Analysing and Time horizon, although not substantially, were on average smaller as compared to the ‘Smaller companies’ group.

The Mann-Whitney U test was applied to evaluate whether the mean rank of the 'Larger companies' group differs significantly from the mean rank for the 'Smaller companies' group. The test results showed that only the differences in using the *Weak tie sources* (mean of 3.12 in 'Smaller companies' as compared to mean of 3.52 in 'Larger companies') as well as Knowledge base (mean of 3.09 in 'Smaller companies' as compared to mean of 3.25 in 'Larger companies') are statistically significant (Annex 3). Based on these results, it was concluded that size (in a group above 50 employees) in principle does not have a major role for organisational foresight capabilities or innovation, hence company size variable was not included in the further statistical analysis.

5.3.3. Does type of industry matter?

The data in a total sample were split forming two groups: group 1 'Companies in high and medium high technology industries' (32 companies), and group 2 'Companies in low and medium low technology industries' (198 companies). Comparisons of the means between these two groups (Annex 3) showed that 'Companies in high and medium high technology industries in a sample had on average larger means for all the organisational foresight categories (except Depth and Analysing), the organisational foresight index and explorative as well as exploitative innovation. The Mann-Whitney U test results showed that the differences in using the *Weak tie sources* (mean of 3.01 in group 2 as compared to mean of 4.04 in group 1), *Visioning* (mean of 4.93 in group 2 as compared to mean of 5.36 in group 1), *Knowledge base* (mean of 2.97 in group 2 as compared to mean of 3.83 in group 1) as well as the *Organisational foresight index* (mean of 4.48 in group 2 as compared to mean of 4.84 in group 1) are statistically significant (Annex 3). Differences in other scores were not statistically significant.

Based on these results it can be concluded that, on average, companies operating in high and medium high technology sectors tend to invest more in their knowledge base (employee education, organisational learning and R&D), networking with weak tie sources (e.g. research institutes), and visioning long term strategies. Also, on average, the degree of organisational foresight is stronger in high and medium high technology sectors. However, since only the differences in three organisational foresight categories out of 8 were statistically significant, industry type variable was not included in further statistical analysis.

5.3.4. Does access to external financial aid matter?

The Mann-Whitney U test was applied to evaluate whether the mean rank of the companies who received external financial aid for R&D and innovation in the period of last three years (group 1 'Yes', 67 companies) differs significantly from the mean rank for the companies who didn't (group 2 'No', 154 companies). 9 companies answered 'I don't know' to this question; hence their responses were eliminated from analysis. Comparisons of the means between these two groups (Annex 3) showed that group 1 ('Yes') had on average larger means for all the studied variables. The Mann-Whitney U test results showed that the differences in all the categories (excluding Depth of scanning and Coordination) are statistically significant.

This could mean that (a) either access to external financial aid serves as a push for additional investments into innovation and organisational foresight capabilities, or (b) companies that have higher organisational foresight capabilities are also more successful in attracting external aid (loans, subsidies, risk capital etc.) for innovation development. Since access to external aid was a nominal variable it could not be included in the correlation or regression analysis.

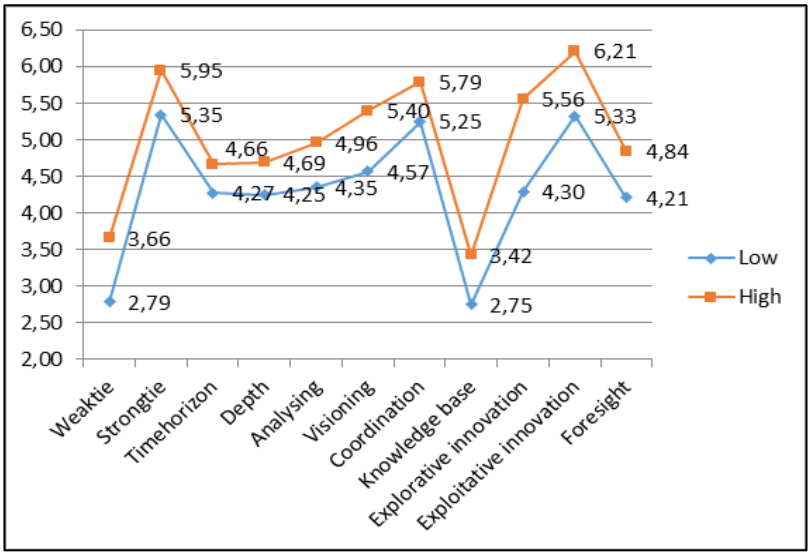
5.3.5. Does technological turbulence in the company's environment matter?

Rapid technological changes in an industry reflect technological turbulence. Firms facing significant and persistent technological changes can adapt by utilizing their capabilities. In contrast, under low technological turbulence, they do not face serious demands to respond to technological changes. Rohrbeck (2010) and Day and Schoemaker (2005) argued that technological turbulence in a firm's external environment serves as stimulus for higher degree of organisational foresight. To test this proposition that has not been investigated with quantitative means, the Mann-Whitney U test was applied. The data were split around the mean value of technological turbulence (4.52 out of 7) in a total sample, thus forming two groups: group 1 'Low technological turbulence' (113 companies) and group 2 'High technological turbulence' (117 companies).

The Mann-Whitney U test results showed that the differences in all the categories of organisational foresight and ambidexterity were statistically significantly (Annex 3) higher (Figure 19) in the group 2 'High technological turbulence. Based on these results it can be concluded that firms facing higher than average technological

turbulence have also stronger organisational foresight capabilities and greater innovation results (notably, the mean difference in explorative or radical innovation is relatively larger compared to the differences in other categories).

Figure 19. Differences in groups facing 'higher' and 'lower' technological turbulence



Further investigation of what firms typically face higher than average technological turbulence, the nonparametric tests of Mann-Whitney-Wilcoxon revealed that differences according industry type were not statistically significant (p value = 0.157, see Annex 3). However company size matters – the technological turbulence differences in 'larger companies' group (mean of technological turbulence 6.08) and 'smaller companies' group (mean 3.92) were statistically significant (p value = 0.000, see Annex 3).

This study did not aim to investigate in detail the drivers or antecedents of organisational foresight. However, these results provide the basis for future studies and deeper investigation into the effects of technological turbulence and other drivers (e.g. types of strategies and competitive advantage) of organisational foresight.

5.4. RELATIONSHIP BETWEEN ORGANISATIONAL FORESIGHT AND ORGANISATIONAL AMBIDEXTERITY

In this chapter, the relationships among organisational learning dimensions and organisational ambidexterity's dimensions are examined. Both correlation analysis and regression analyses were conducted to explore the relationships among these

constructs. The results from the correlation matrix and a structural model of relationships as well as the results of the hypotheses testing are reported.

5.4.1. Methodological approach to computing the scores for hypothesis tests

Two main approaches to factor score computation are reflected by the refined (e.g. standardized factor scores following factor analysis) and non-refined methods (e.g. sum scores method).

From the first glance, refined method seems more exact. However, while factor scores following e.g. exploratory factor analysis (EFA) are relatively easy to create, there are several risks. First, factor scores are sensitive to the factor extraction method and rotation method used to create the EFA solution - factor scores obtained with different EFA selections may be different as well. This could affect follow-up tests if factor scores for the same case differ widely across different extraction and rotation methods, and consequently misleading hypothesis test results may occur (DiStefano et al., 2009). A second consideration when creating factor scores using refined methods is the problem of 'indeterminacy' of the scores (Grice, 2001). Indeterminacy arises from the fact that, under the common factor model, the parameters are not uniquely defined, due to the choice of the communality estimate. This means that there is not a unique solution for the factor analysis results and, theoretically, an infinite number of solutions could account for the relationships between the items and factor(s). Therefore, it also follows that the factor scores are not uniquely defined (Grice, 2001). The problem of indeterminacy could impact not only the factor scores but also the validity of decisions that rely upon these scores (Grice, 2001). For example, under some conditions, rankings of cases in a data set may vary widely based on different methods to compute factor scores, leaving a researcher unsure as to which ranking to trust (DiStefano et al, 2009).

A third issue deals with data quality and properly screening the factor scores. Once factor scores are obtained, this set of data requires screening and examination to ensure that distribution of factor scores meet assumptions required by the statistical methodology to be used for follow-up testing. Factor scores are 'new' data for a follow-up analysis and are subject to the same screening recommendations. Factor scores may be skewed and/or non-normal, especially if non-refined methods were used to create the scores. Further action (e.g., transformations) may be needed before using factor scores in subsequent analyses. Failure to properly screen the factor scores may

result in results of hypothesis tests that could provide misleading or even incorrect information (DiStefano et al, 2009).

An alternative to the refined method described above is summing scores by factor - a way to estimate factor scores for each individual factor by summing raw scores corresponding to all items loading on a factor (Comrey and Lee, 1992). For this method average scores are computed to retain the scale metric, which may allow for easier interpretation. Also, average scores may be useful to foster comparisons across factors when there are differing numbers of items per factor. In addition, summed factor scores preserve the variation in the original data. While sum scores may be acceptable for many studies, there are also some considerations. All items per factor are given equal weight, regardless of the loading value. Therefore, items with relatively low loading values are given the same weight in the factor score as items with higher loading values. If items are on different metrics, ignoring different amounts of variability in the observed variables might result in less reliable factor scores.

Given the considerations above, the sum score method was chosen to compute factor scores for hypothesis testing. All items were on the same Likert-type scale from 1 to 7 (the three items out of 40 that were on the percent scale were decoded to 7 point Likert-type scale to meet this purpose). If the factors resulting from the exploratory factor analysis had been used to create the indexes, the weighting among the items would have been skewed compared to the theoretical definition of organisational foresight and ambidextrous innovation (the items in the factors resulting from the exploratory factor analysis were not equally distributed on the theoretical sub-components) (Amsteus, 2011).

Sum scores method allowed creating the second-order and third-order indexes of organisational foresight and its dimensions required to test the hypotheses. Index creation (formative approach) versus scale creation (reflexive approach) has been discussed by several scholars (see e.g. Amsteus, 2011, Diamantopoulos and Siguaw, 2006). The most prevalently used model-design is reflexive, but a number of studies have found constructs which have incorrectly been operationalized as reflective (Amsteus, 2011, p.51). Moreover, there are only rare examples when the chosen approach is explicitly motivated (Diamantopoulos and Siguaw, 2006), while in fact data imply that managerial constructs in the marketing discourse are more often formative than reflexive in character. Importantly, incorrect specification of the measurement model can affect the conclusions with regard to the relationships between latent

constructs (Jarvis et al., 2003). Comparing the formative or index approach as an alternative to the scale development approach, both index and conventional scale development scholars view the development of a measure as a multi-step process (cf. Amsteus, 2011). The methodological guidelines with regard to the first part of measure development (item generation) are similar for both approaches, and this may be equally or even more important with regard to index construction, where the indicators have to cover the whole range of the latent variable in accordance with the content description. The main difference between reflexive (scale) and formative (index) approaches is that the formative model neither demands nor presumes items to be correlated. It would make a complete sense for formative indicators to be entirely uncorrelated (moreover, multicollinearity among formative indicators can be a troublesome). Hence, reliability in the form of internal consistency such as Cronbach's alpha is not required as a criterion for appraising the adequacy of formative models (cf. Amsteus, 2011).

In this research, organisational foresight has been described by a third-order capabilities model, which is formative (an index), but it consists of first-order reflexive constructs. Similarly, organisational ambidexterity is a second-order formative model, which consists of first-order reflexive constructs. The number of items on each subcomponent was taken into account by creating an average (dividing the sum of the score on the items with the number of items), and then an average was created for each factor, which together formed the organisational foresight index. For each respondent, the scores on the items of the scale were converted so that a higher value reflected a higher degree of organisational foresight. Scores were summarised on each factor in accordance of the measurement model and weighted so that each component is equally represented to create an organisational foresight index. First, the items belonging to each theoretical component (a first-order factor) were summarised. Then the sum was divided by the number of items belonging to each first-order factor. So were created the scores for ten first-order factors. Next the scores of the factors were summarised and the sum was divided by the number of first-order factors. So were created the indexes of environmental scanning, strategic selection and integrating capabilities. Finally, the scores belonging to second-order indexes were summarised and divided by the number of second-order factors (indexes) to create an index of organisational foresight. Cronbach's alpha for the organisational foresight was 0.802, which indicate good internal consistency. Cronbach's alphas for

environmental scanning, strategic selection and integrating capabilities indexes ranged from 0.623 and 0.801.

5.4.2. Correlation analysis

Statistical analysis was performed to test correlations among the first-order variables, which is more accurate in contracts to testing the correlations between second-order or third-order variables. In the correlation analysis, positive correlation values between 0.10 and 0.39 are referred to as weak positive relationships, between 0.40 and 0.69 as moderate positive relationships, and 0.70 and above as high positive relationships (Cohen et al, 2003).

Table 19. Interpretation of correlation results

Correlation coefficient	Interpretation	
0.00-0.30	Very weak correlation	Very weak link
0.20-0.39	Weak correlation	Weak link
0.40-0.69	Moderate correlation	Moderate link
0.70-0.89	High correlation	Strong link
0.90-1.00	Very high correlation	Very strong link

Source: Cohen et al (2003)

The results of Kolmogorov-Smirnov tests for normality indicated non-normal distribution. Hence correlation was tested by Spearman's rho.

Table 20 shows the correlation matrix of all dimensions of the two constructs being studied – organisational foresight and organisational ambidexterity (explorative and exploitative innovation separately). Correlations between the scales of organisational foresight and explorative as well as exploitative innovation ranged from weak to moderate (from 0.228 to 0.573). Similarly, inter-correlations among the different dimensions of organisational foresight ranged from weak to moderate (from 0.189 to 0.680). In addition, the correlation between the scales of organisational foresight dimensions and organisational ambidexterity's dimensions was found to indicate positive relationships between all the dimensions of organisational foresight and the two dimensions of organisational ambidexterity.

The results indicate that:

(1) All the dimensions of organisational foresight (strong tie sources, weak tie sources, time horizon, depth of scanning, analysing, visioning, coordination and

knowledge base) have a weak-moderate relationship with both exploitative and explorative innovation.

(2) The relationships of all the separate environmental scanning dimensions with explorative innovation are stronger than relationships with exploitative innovation.

(3) The relationships of all the separate strategic selection dimensions (visioning and analysing) with exploitative innovation are stronger than relationships with explorative innovation.

(4) The relationships of all the separate integrating capabilities dimensions (coordination and knowledge base) with exploitative innovation are stronger than relationships with explorative innovation.

(5) Coordination (0.572), visioning (0.500) and knowledge base (0.477) have the strongest relationships with exploitative innovation (of all organisational foresight dimensions).

(6) Visioning (0.425), strong tie sources (0.416), weak tie sources (0.412) and knowledge base (0.402) have the strongest relationships with explorative innovation (of all organisational foresight dimensions). Hence, the relationship of strong tie sources with explorative innovation is stronger than the relationship of weak tie sources and explorative innovation.

(7) Separate organisational foresight dimensions are weakly-to-moderately correlated. For example, strategic selection dimensions (analysing and visioning) and integrating capabilities dimensions (coordination and knowledge base) are correlated, from 0.420 and 0.632. Strategic selection dimensions (analysing and visioning) and integrating capabilities dimensions (coordination and knowledge base) are correlated, from 0.420 and 0.632. Usage of strong tie sources is moderately related to the usage of weak tie sources (0.405), and has a weak positive relationship to all the other organisational dimensions, ranging from 0.189 (Analysing) to 0.327 (Visioning). Usage of weak tie sources has a moderate positive relationship to knowledge base (0.544). Knowledge base is moderately correlated to Visioning (0.632), weak tie sources (0.544), coordination (0.539) and analysing (0.420). The correlations to strong tie sources, depth of scanning and time horizon are weak (from 0.209 to 0.291). Time horizon has a moderate positive relationship with Visioning (0.439). Depth of scanning has a moderate positive relationship with analysing (0.462).

Table 20. Correlations among first-order variables

		Exploitative innovation	Explorative innovation	Strong tie sources	Weak tie sources	Time horizon	Depth of scanning	Analysing	Visioning	Coordination	Knowledge base
Exploitative innovation	Spearman's rho	1.000	.573**	.306**	.256**	.228**	.262**	.371**	.500**	.572**	.477**
	Sig. (2-tailed)		.000	.000	.000	.000	.000	.000	.000	.000	.000
Explorative innovation	Spearman's rho		1.000	.416**	.412**	.330**	.329**	.361**	.425**	.358**	.402**
	Sig. (2-tailed)		.	.000	.000	.000	.000	.000	.000	.000	.000
Strong tie sources	Spearman's rho			1.000	.405**	.258**	.212**	.189**	.327**	.279**	.291**
	Sig. (2-tailed)			.	.000	.000	.001	.004	.000	.000	.000
Weak tie sources	Spearman's rho				1.000	.230**	.301**	.307**	.377**	.274**	.544**
	Sig. (2-tailed)				.	.000	.000	.000	.000	.000	.000
Time horizon	Spearman's rho					1.000	.306**	.350**	.439**	.255**	.279**
	Sig. (2-tailed)					.	.000	.000	.000	.000	.000
Depth of scanning	Spearman's rho						1.000	.462**	.370**	.273**	.209**
	Sig. (2-tailed)						.	.000	.000	.000	.001
Analysing	Spearman's rho							1.000	.680**	.505**	.420**
	Sig. (2-tailed)							.	.000	.000	.000
Visioning	Spearman's rho								1.000	.617**	.632**
	Sig. (2-tailed)								.	.000	.000
Coordination	Spearman's rho									1.000	.539**
	Sig. (2-tailed)										.000
Knowledge base	Spearman's rho										1.000
	Sig. (2-tailed)										.

**. Correlation is significant at the 0.01 level (2-tailed).

5.4.3. Regression analysis

Correlation analysis suggested that there are statistically significant relationships between the independent and dependent variables. Multiple regression analysis allows examining the relationships between multiple variables simultaneously. All statistical analyses were performed using SPSS 21 statistical package programme. The relationships between the independent variable organisational foresight index, and it's separate dimensions (environmental scanning, strategic selection, integrating capabilities and their first-order factors) and the dependent variable ambidextrous innovation (exploitative innovation and explorative innovation) were determined by using multiple linear regression analysis. Regression coefficients were tested by a t statistic. The quality of the regression was measured by the coefficient of determination (R2).

Regression assumptions. Before proceeding with the regression analysis, regression assumptions were tested. When these assumptions are not met the results may not be trustworthy, resulting in type I or Type II errors, over- or under-estimation of significance or effect size. The first assumption is that the *variables are continuous*. The organisational foresight capabilities, explorative and exploitative innovation were tested using Likert-type 7-point scales that suggest some application of equal intervals. Thus, the variables are considered continuous and are suitable for regression analysis.

Secondly, multiple regressions can only accurately estimate the relationship between dependent and independent variables if the *relationships are linear* in nature. A preferable method of detection is examination of residual plots (plots of the standardised residuals as a function of standardised predicted values). Scatterplots that plot independent variables against the dependent variables (explorative and exploitative innovation) were visually inspected and suggested linear relationships.

Third, variables with *substantial outliers* can distort relationships and significance tests. Casewise diagnostics and box-plots identified four extreme outliers with values outside 3 standard deviations (responses No. 123, 169, 177 and 187). After examining the data with and without the outlier values, it was concluded that value replacement does not change the estimation of significance and would not distort the results. Therefore, the values of responses No. 123, 169, 187 and 177 were transformed to reflect the mean values of responses of the total sample.

The fourth assumption of *independence of observations* was checked with Durbin-Watson test. The Durbin-Watson statistic ranges in value from 0 to 4. A value

near 2 indicates non-autocorrelation; a value toward 0 indicates positive autocorrelation; a value toward 4 indicates negative autocorrelation. Table 21 shows that the values of the test were around 2 indicating non-autocorrelation.

Table 21. Durbin-Watson test

	Dependent Variable: Exploitative innovation	Dependent Variable: Explorative innovation
Predictors: (Constant), Knowledgebase, Depth, Timehorizon, Strongtie, Analysing, Coordination, Weaktie, Visioning	2.008	1.680

The fifth assumption tested for *heteroscedasticity*, which is indicated when the variance of errors differs at different values of the independent variable. According to Berry and Feldman (1985) and Tabachnick and Fidell (1996) slight heteroscedasticity has little effect on significance tests, but when heteroscedasticity is marked it can lead to serious distortion of findings and seriously weaken the analysis thus increasing the possibility of a type I error. This assumption was checked by visual examination of the standardised residuals plots by the regression standardised predicted value. The visual examination of the plots concluded that the variances are evenly distributed along the line of best fit, and data are homoscedastic.

Sixth, *multicollinearity* issues were examined. VIF (Variance inflation factor) was used as an indicator of multicollinearity. Ideally, VIF for each independent variable should not be greater than 5 (Schroeder, 1990). VIF for each of the first-order factors was between 1 and 4 (see Table 22), so multicollinearity is not an issue.

The collinearity diagnostics also indicated that the Condition Indexes (CI) were all below 30, therefore no multicollinearity issues were identified and the assumption of collinearity was met.

Table 22. Collinearity statistics for first-order factors

Model		Collinearity Statistics Exploitative innovation		Collinearity Statistics Explorative innovation	
		Tolerance	VIF	Tolerance	VIF
1	Weak tie	.551	1.814	.551	1.814
	Strong tie	.745	1.342	.745	1.342
	Time horizon	.809	1.236	.809	1.236
	Depth	.746	1.341	.746	1.341
	Analysing	.492	2.031	.492	2.031
	Visioning	.310	3.223	.310	3.223
	Coordination	.515	1.941	.515	1.941
	Knowledge base	.426	2.347	.426	2.347

Finally, it was checked if the *residuals were approximately normally distributed*. Visual diagnostics of the histograms with a superimposed normal curve and normal P-P plots confirmed that the standardised residuals of the dependent variables are approximately normally distributed**.**

Some sources state that regression requires that variables have normal distributions. However, other sources (e.g. Johnson et al., 2006) note that normality of the variables is not a necessary precondition in regression as long as the distribution of the residuals is normal and the reliability and validity of the constructs are ensured.

Table 23. Normality tests

	Kolmogorov-Smirnov[a]			Shapiro-Wilk		
	Statistic	df	Sig.	Statistic	df	Sig.
Exploitative innovation	.149	230	.000	.904	230	.000
Explorative innovation	.120	230	.000	.953	230	.000

Therefore, despite that Kolmogorov-Smirnov normality test results (Table 23) showed non-normal distribution of the dependent variables, it was concluded that the necessary assumptions of regression are met.

Results. The results of regression analysis between the independent variables (Organisational foresight index, Environmental scanning and its first-order variables, Strategic selection and its first-order variables, Integrating capabilities and its first-order variables) and the dependent variable *Explorative innovation* confirm that (see Table 24):

(1) There is a statistically significant positive relationship between organisational foresight index and explorative innovation. Organisational foresight explains about 40 percent of explorative innovation.

(2) There is a statistically significant positive relationship between all three second-order variables (environmental scanning, strategic selection and integrating capabilities) and explorative innovation, and their first-order variables and explorative innovation. It means that the full set of first-order factors has explanatory power and contributes to explorative (radical) innovation.

(3) The strongest positive relationship is between environmental scanning and explorative innovation, compared to Strategic selection and Integrating capabilities.

Table 24. Results of linear regressions, dependent variable - explorative innovation

Variable	R	Adjusted R Square	Unstandardized Coefficients		Standardized Coefficients	t	sig
			B	Std. Error	Beta		
Organisational foresight (OF)	**.634**	**.400**	**.953**	**.077**	**.634**	**12.388**	**.000**
OF first order factors	.692	.461					
Environmental scanning (OE)	**.649**	**.418**	**.918**	**.071**	**.649**	**12.866**	**.000**
OE first order factors	.656	.420					
Weak tie sources			.197	.049	.233	4.038	.000
Strong tie sources			.330	.058	.326	5.736	.000
Time horizon			.181	.054	.177	3.324	.001
Depth			.213	.054	.213	3.932	.000
Strategic selection (SS)	**.481**	**.228**	**.520**	**.063**	**.481**	**8.295**	**.000**
SS first order factors	.487	.230					
Analysing			.174	.076	.181	2.280	.024
Visioning			.352	.081	.345	4.345	.000
Integrating capabilities (IC)	**.507**	**.253**	**.708**	**.080**	**.507**	**8.870**	**.000**
IC first order factors	.507	.250					
Coordination			.339	.081	.288	4.210	.000
Knowledge base			.370	.088	.288	4.222	.000

The results of regression analysis between the independent variables (Organisational foresight index, Environmental scanning and its first-order variables, Strategic selection and its first-order variables, Integrating capabilities and its first-order variables) and the dependent variable *Exploitative innovation* confirm that (see Table 25):

(1) There is a statistically significant positive relationship between the organisational foresight index and exploitative innovation. Organisational foresight explains about 42 percent of exploitative innovation (about 50 percent in a multiple regression model with first-order factors).

(2) There is a statistically significant positive relationship between all three second-order variables (environmental scanning, strategic selection and integrating capabilities) and exploitative innovation.

(3) The strongest positive relationship is between integrating capabilities and exploitative innovation, compared to Strategic selection and Environmental scanning)).

(4) Strong tie sources and depth of scanning have a statistically significant positive relationship to exploitative innovation. The relationships between weak tie sources and time horizon and dependent variable exploitative innovation are not

statistically significant. Environmental scanning variables altogether explain only 19 percent of exploitative innovation, hence its effect on exploitative innovation is weakest compared to other groups of capabilities.

(5) There is a statistically significant positive relationship between visioning and exploitative innovation. The relationship between independent first-order variable analysing and exploitative innovation is not statistically significant. Strategic selection variables altogether explain about 30 percent of exploitative innovation.

(6) There is a statistically significant positive relationship between coordination and exploitative innovation, and between knowledge base and exploitative innovation. Integrating capabilities altogether explain about 45 percent of exploitative innovation.

Table 25. Results of multiple linear regressions in the total sample, dependent variable - exploitative innovation

Variable	R	Adjusted R Square	Unstandardized Coefficients		Standardized Coefficients	t	sig
			B	Std. Error	Beta		
Organisational foresight (OF)	**.647**	**.417**	**.847**	**.066**	**.647**	**12.827**	**.000**
OF first order factors	.723	.506					
Environmental scanning (OE)	**.436**	**.186**	**.537**	**.073**	**.436**	**7.314**	**.000**
OE first order factors	.451	.190					
Weak tie sources			.077	.050	.104	1.524	.129
Strong tie sources			.242	.059	.274	4.074	.000
Time horizon			.095	.056	.107	1.706	.089
Depth			.137	.056	.157	2.451	.015
Strategic selection (SS)	**.543**	**.291**	**.510**	**.052**	**.543**	**9.755**	**.000**
SS first order factors	.570	.319					
Analysing			.074	.063	.088	1.179	.240
Visioning			.450	.066	.506	6.775	.000
Integrating capabilities (IC)	**.674**	**.452**	**.820**	**.060**	**.674**	**13.775**	**.000**
First order factors	.697	.485					
Coordination			.598	.058	.582	10.244	.000
Knowledge base			.200	.064	.179	3.151	.002

In the previous research organisational ambidexterity has been calculated from the level of exploration and exploitation by taking the sum of both (Jansen, Tempelaar et al. 2009) or by taking the multiplicative interaction of both (Jansen, George et al. 2008). Middelbeek (2010) calculated both sum-ambidexterity and product-ambidexterity, and the results for both calculated ambidexterity constructs were very similar and the same conclusions were valid. In addition to the above-described

regression results, this study also calculated the results for ambidexterity from the sum of exploration and exploitation. The regression results (Table 26) also supported the positive relationship between foresight and ambidexterity.

Table 26. Results of linear regression, dependent variable – ambidexterity

Independent variable	R	Adjusted R Square	Unstandardized Coefficients		Standardized Coefficients	t	sig
			B	Std. Error	Beta		
Organisational foresight	.713	.507	1.800	.117	.713	15.366	.000

The results of the regression analysis confirm hypotheses H1, H1a, H1b, H1c - there is a positive relationship between organisational foresight capabilities and organisational ambidexterity (sum-ambidexterity and both explorative and exploitative innovation when analysed separately). However, hypotheses H2, H2b, H2c are rejected - the positive relationship between organisational foresight (and also Strategic Selection, Integrating capabilities) and explorative innovation is *slightly weaker* than the positive relationship between organisational foresight (and also Strategic Selection, Integrating capabilities) and exploitative innovation. Nevertheless, the hypothesis H2a is confirmed - the positive relationship between environmental scanning and explorative innovation is stronger than the positive relationship between environmental scanning and exploitative innovation (beta = 0.649 versus beta = 0.436). Moreover, the regression with first-order factors suggested that all organisational foresight first-order capabilities contribute to explorative innovation, whereas the contribution of scanning the *weak tie sources* in a short-to-long-term *time horizon* and *analysing* the results to exploitative innovation was not confirmed statistically (the relationships of these three variables to exploitative innovation was not statistically significant).

5.4.4. Moderating effects

Statistical analysis was completed to test the moderating effects, i.e. that strategic selection and integrating capabilities moderate the relationship between other organisational foresight capabilities and organisational ambidexterity.

Strategic selection. Firstly, the moderating effects of strategic selection capabilities were tested. It was hypothesized that strategic selection capabilities moderate the relationship between environmental scanning and organisational

ambidexterity so that in firms with higher degree of strategic selection capabilities the relationship between environmental scanning and explorative and exploitative innovation is also higher.

To test this hypothesis, a moderator based on standardised values of Environmental scanning and Strategic selection was created and tested in linear regression analysis with the dependent variable of exploitative innovation. ANOVA results showed that both models 1 (predictors: strategic selection, environmental scanning) and model 2 (predictors: strategic selection, environmental scanning, moderator) had explanatory power (p values in both models equalled 0.000). Moreover, summary of model fit (Annex 4) showed that in the case of model 2 the Adjusted R Square increased from 0.317 to 0.348.

The regression coefficients were significant (Annex 4), hence the statistical significance of the moderator was confirmed. However, the analysis showed that the strength of the relationship between environmental scanning capabilities and exploitative innovation did not improve in the case of higher strategic selection capabilities, and remained more or less the same.

Regression with the dependent variable of explorative innovation provided similar results – although the model and the regression coefficients were statistically significant (see Annex 4), the moderating effects did not improve the strength of the relationship between environmental scanning capabilities and explorative innovation. Hence, the *hypothesis 3 was rejected*.

Integrating capabilities. The moderating effects of integrating capabilities were tested following similar methodology. It was hypothesized that integrating capabilities moderate:

- (Hypothesis 4a) the relationship between environmental scanning and organisational ambidexterity so that in firms with higher degree of integrating capabilities the relationship between environmental scanning and explorative and exploitative innovation is also higher;
- (Hypothesis 4b) the relationship between strategic selection and organisational ambidexterity so that in firms with higher degree of integrating capabilities the relationship between strategic selection and explorative and exploitative innovation is also higher.

To test this hypothesis, first, a moderator based on standardised values of Environmental scanning and Integrating capabilities was created and tested in linear

regression analysis with the dependent variable of explorative innovation. ANOVA results showed that both models 1 (predictors: integrating capabilities, environmental scanning) and model 2 (predictors: integrating capabilities, environmental scanning, moderator) had explanatory power (p values in both models equalled 0.000). The summary of model fit (Table 27) showed that in the case of model 2 the explanatory power of the model (Adjusted R Square) increased from 45.6 percent to 47.1 percent. Moreover, the analysis showed that the strength of the relationship between environmental scanning capabilities and explorative innovation in the case of Model 2 slightly increased – the value of Beta increased from 0.528 to 0.543 (Table 28).

Table 27. Model fit test results: regression analysis on integrating capabilities as a moderator, dependent variable – explorative innovation

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate
1	.679[a]	.461	.456	.88365
2	.692[b]	.478	.471	.87084

a. Predictors: (Constant), SCANNING, INTEGRATING

b. Predictors: (Constant), SCANNING, INTEGRATING, moderator_integra

Table 28. Regression coefficients, integrating capabilities as a moderator, dependent variable – explorative innovation

Model		Unstandardized Coefficients		Standardized Coefficients	t	Sig.
		B	Std. Error	Beta		
1	(Constant)	.201	.350		.573	.567
	SCANNING	.747	.081	**.528**	9.264	.000
	INTEGRATING	.326	.080	.233	4.097	.000
2	(Constant)	.348	.349		.996	.320
	SCANNING	.769	.080	**.543**	9.626	.000
	INTEGRATING	.286	.080	.204	3.577	.000
	moderator_integra	-.132	.048	-.136	-2.779	.006

Regression with exploitative innovation the dependent variable provided similar results – the model and the regression coefficients were statistically significant (see Tables 29 and 30), and the moderating effects slightly improved the strength of the relationship between environmental scanning capabilities and exploitative innovation (beta coefficient of environmental scanning increased from 0.119 to 0.141.

Table 29. Model fit test results: regression analysis on integrating capabilities as a moderator, dependent variable – exploitative innovation

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate
1	.682[a]	.465	.460	.76631
2	.708[b]	.501	.494	.74168

a. Predictors: (Constant), INTEGRATING, SCANNING

b. Predictors: (Constant), INTEGRATING, SCANNING, moderator_integra

Table 30. Integrating capabilities as a moderator, dependent variable – explorative innovation

Model		Unstandardized Coefficients		Standardized Coefficients	t	Sig.
		B	Std. Error	Beta		
1	(Constant)	1.914	.304		6.302	.000
	INTEGRATING	.745	.069	.612	10.790	.000
	SCANNING	.147	.070	**.119**	2.097	.037
2	(Constant)	2.096	.297		7.048	.000
	INTEGRATING	.695	.068	.571	10.218	.000
	SCANNING	.173	.068	**.141**	2.550	.011
	moderator_integra	-.164	.041	-.193	-4.041	.000

Although the differences were not great, the *hypothesis 4a was confirmed*.

Then, a moderator based on standardised values of Strategic selection and Integrating capabilities was created and tested in linear regression analysis with the dependent variable of exploitative innovation. ANOVA results showed that both models 1 and model 2 (including moderator) were meaningful (p values in both models equalled 0.000), and the explanatory power of the model (Adjusted R Square) increased from 46.5 percent to 48.5 percent (Annex 4). The regression coefficients (see Annex 4) were significant, hence proving the moderating effects of integrating capabilities. However, the analysis showed that the strength of the relationship between strategic selection capabilities and exploitative innovation decreased in the case of Model 2. Hence, it is concluded that with increasing integrating capabilities (coordination and knowledge base) the power of strategic selection capabilities (analysing and visioning) decreases in the case of its relationship to exploitative innovation.

Similar analysis including explorative innovation was completed. The analysis showed that the regression coefficients of the moderating variable were not statistically significant (see Annex 4). Taking into account the results of regression analysis on both explorative and exploitative innovation, the *hypothesis 4b was rejected*.

5.5. SUMMARY OF EMPIRICAL RESEARCH FINDINGS

In this chapter, the results of the data analyses were reported with a series of statistical procedures, and a number of findings were made to address the research question and to examine the hypotheses in the study. According to the reliability evidence and statistical analysis results on validity, the questionnaire and the research model is moderately acceptable in its entirety. The research model was refined after

the reliability analysis based on Cronbach's alphas, and the exploratory factor analysis. Overall, the data collected through the questionnaire are fairly reliable and valid for this study.

Through descriptive statistics, the study found that participants in the sample enterprises had the highest overall score on the usage of strong tie sources (mean of 5.63 on the 7 point scale), coordination (5.54) and visioning (4.99), and the lowest overall score on knowledge base (3.03) and weak tie sources (3.20). The overall scores on time horizon, depth of scanning and analysing were in the middle (between 4.24 and 4.64). The study found that the average score of organisational foresight index in the Lithuanian manufacturing companies was 4.52 (in the 7 point scale). The study also found that participants in the sample enterprises had the highest overall score on the exploitative (incremental) innovation (5.74), and the score on explorative innovation was lower (4.82).

Based on Mann-Whitney U test results, it was concluded that size (in a group above 50 employees) in principle does not have a major role for organisational foresight capabilities or innovation, hence company size variable was not included in the further statistical analysis. Also, it was concluded that, on average, companies operating in high and medium high technology sectors tend to invest more in their knowledge base (employee education, organisational learning and R&D), networking with weak tie sources (e.g. research institutes), and visioning long term strategies. Also, on average, the degree of organisational foresight is stronger in high and medium high technology sectors. On average, those companies that had attracted external aid (either loans, or subsidies, risk capital) for innovation, also had stronger organisational capabilities and higher scores for explorative and exploitative innovation. This could mean that (a) either access to external financial aid serves as a push for additional investments into innovation and organisational foresight capabilities, or (b) companies that have higher organisational foresight capabilities are also more successful in attracting external aid for innovation development. Based on Mann-Whitney U test results it was concluded that firms facing higher than average technological turbulence have also stronger organisational foresight capabilities and greater innovation results (notably, the mean difference in explorative or radical innovation is relatively larger compared to the differences in other categories).

The correlations between (a) the scales of different first-order dimensions of organisational foresight and (b) explorative as well as exploitative innovation ranged

from weak to moderate (from 0.228 to 0.573). Similarly, inter-correlations among the constructs of different organisational foresight first-order capabilities ranged from weak to moderate (from 0.189 to 0.680). In addition, correlation analysis results indicated positive relationships between all the dimensions of organisational foresight and the two dimensions of organisational ambidexterity. Thus, correlation analysis confirmed that there are statistically significant relationships between the independent and dependent variables.

Multiple regression analysis allowed to examine the direction of these relationships more closely (see Figures 20 and 21 below).

Environmental scanning had the strongest positive relationship to explorative innovation (beta = 0.649, compared to 0.507 (integrating capabilities) and 0.481 (strategic selection)). Integrating capabilities had the strongest positive relationship to exploitative innovation (beta = 0.630, compared to 0.543 (strategic selection) and 0.436 (environmental scanning)).

The organisational foresight's contribution to exploitative innovation was stronger than its contribution to explorative innovation (beta =0.634 in its relationship to explorative innovation and beta = 0.647 in its relationship to exploitative innovation), thus hypothesis H2 was rejected. Similarly, the relationship between strategic selection and exploitative innovation, and the relationship between integrating capabilities and exploitative innovation were stronger that their relationships to explorative innovation, thus rejecting hypotheses H2b and H2c. However, the hypothesis H2a was supported - the positive relationship between environmental scanning and explorative innovation was stronger than the positive relationship between environmental scanning and exploitative innovation (beta = 0.649 versus beta = 0.436).

Figure 20. Organisational foresight and explorative innovation relationship

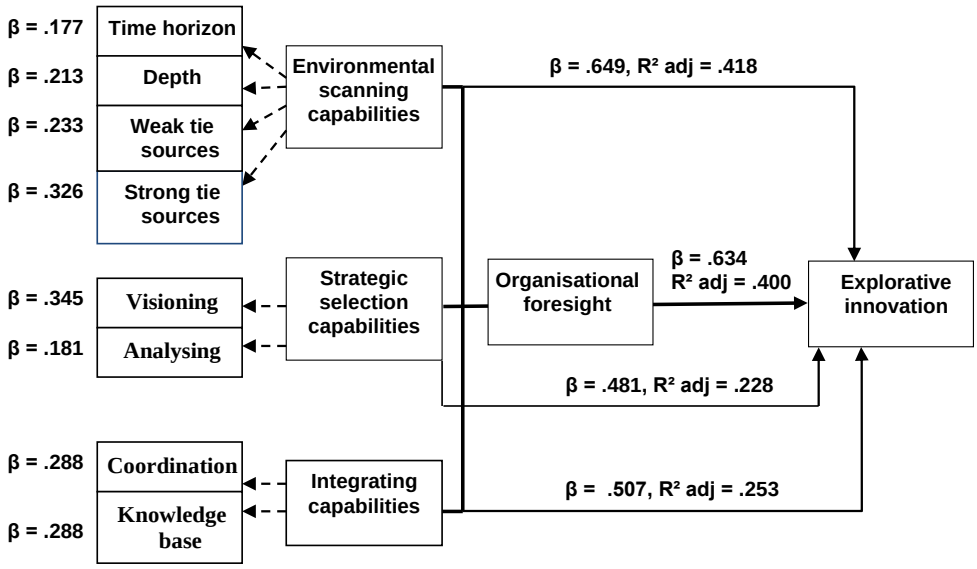
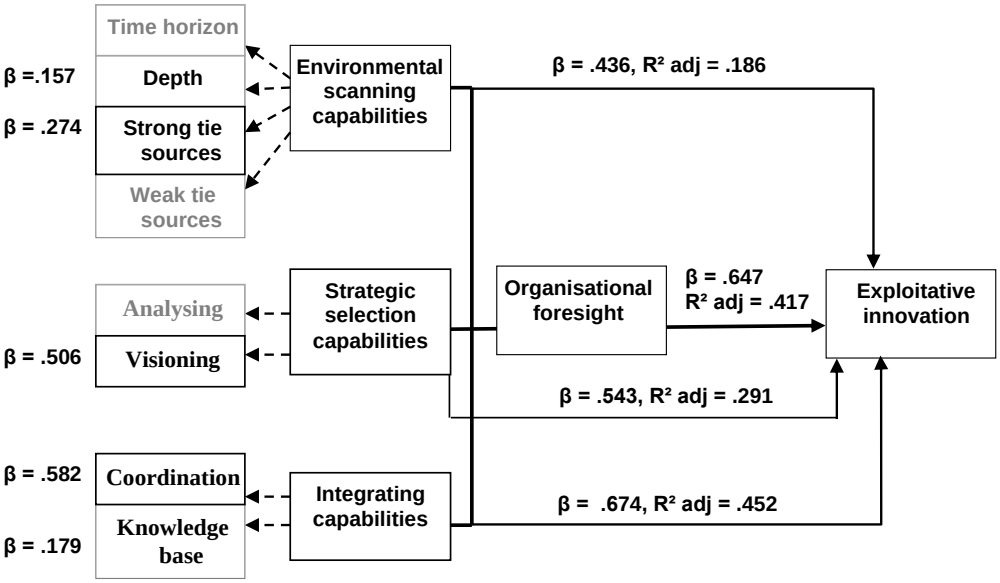


Figure 21. Organisational foresight and exploitative innovation relationship



The organisational foresight's contribution to exploitative innovation was stronger than its contribution to explorative innovation (beta =0.634 in its relationship to explorative innovation and beta = 0.647 in its relationship to exploitative innovation), thus hypothesis H2 was rejected. Similarly, the relationship between strategic selection and exploitative innovation, and the relationship between integrating

capabilities and exploitative innovation were stronger that their relationships to explorative innovation, thus rejecting hypotheses H2b and H2c. However, the hypothesis H2a was supported - the positive relationship between environmental scanning and explorative innovation was stronger than the positive relationship between environmental scanning and exploitative innovation (beta = 0.649 versus beta = 0.436). The results of hypotheses tests are summarised in Table 31 below.

Table 31. Summary of hypothesis tests results

Hypotheses		Results
H1	There is a positive relationship between organisational foresight capabilities and organisational ambidexterity (explorative and exploitative innovation)	Confirmed
H1a	There is a positive relationship between environmental scanning capabilities and organisational ambidexterity.	Confirmed
H1b	There is a positive relationship between strategic selection capabilities and organisational ambidexterity.	Confirmed
H1c	There is a positive relationship between integrating capabilities and organisational ambidexterity.	Confirmed
H2	The relationship between organisational foresight and explorative innovation is stronger than the relationship between organisational foresight and exploitative innovation.	Rejected
H2a	The relationship between environmental scanning and explorative innovation is stronger than the relationship between environmental scanning and exploitative innovation.	Confirmed
H2b	The relationship between strategic selection and explorative innovation is stronger than the relationship between strategic selection and exploitative innovation.	Rejected
H2c	The relationship between integrating capabilities and explorative innovation is stronger than the relationship between integrating capabilities and exploitative innovation.	Rejected
H3	Strategic selection moderates the relationship between environmental scanning and organisational ambidexterity, such that the relationship is weaker under conditions of low strategic selection and stronger under conditions of high strategic selection.	Rejected
H3a	Strategic selection moderates the relationship between environmental scanning and explorative innovation, such that the relationship is weaker under conditions of low strategic selection and stronger under conditions of high strategic selection.	Rejected
H3b	Strategic selection moderates the relationship between environmental scanning and organisational ambidexterity, such that the relationship is weaker under conditions of low strategic selection and stronger under conditions of high strategic selection.	Rejected
H4a	Integrating capabilities moderate the relationship between environmental scanning and organisational ambidexterity, such that the relationship is weaker under conditions of low integrating capabilities and stronger under conditions of high integrating capabilities.	Confirmed
H4b	Integrating capabilities moderate the relationship between strategic selection and organisational ambidexterity, such that the relationship is weaker under conditions of low integrating capabilities and stronger under conditions of high integrating capabilities.	Rejected

Empirical research results did not support the hypotheses on the moderating effects of the strategic selection capabilities, or the moderating effects of integrating capabilities in the strategic selection and ambidexterity relationship. However, statistical analysis confirmed that integrating capabilities acting as a moderator slightly improves the strength of the relationship between environmental scanning capabilities and exploitative or explorative innovation – in the first case, beta coefficient of environmental scanning increased from 0.119 to 0.141, in the second – from 0.528 to 0.543).

The results of regression analysis suggested that organisational foresight explains 41.7 percent of exploitative innovation and 40 percent of explorative innovation. This is less than 50 percent. It it is concluded that the organisational foresight capabilities model should not be used for predicting explorative or exploitative innovation results (and it is not the aim of this dissertation). In conclusion, it is confirmed that the objectives of empirical research are fully achieved.

6. DISCUSSION OF RESEARCH FINDINGS

The goal of this study was to extend the conceptualisation of organisational foresight and by attempting to provide a valid measurement of this construct to shed light on the relationship between organisational foresight and organisational ambidexterity. The study confirmed the importance of organisational foresight, recognising existence of its relationship to both explorative and exploitative innovation, hence - organisational ambidexterity. The discussion of research findings focuses on four key aspects: the conceptualisation of the organisational foresight construct, the formulation and validation of the organisational foresight measurement instrument (scales), the current status of the organisational foresight capabilities in the Lithuanian manufacturing companies, and the relationship between organisational foresight and organisational ambidexterity.

6.1. Conceptualisation of organisational foresight

Many foresight researchers have discussed the meaning or definition of foresight (e.g. Amsteus, 2008; Major et al., 2001; Raimond, 1996; Ratcliffe, 2002; Slaughter, 1996). A number of related definitions have been offered and the concept has been deployed to represent a collection of process steps, exercises, studies, methods, properties, techniques or capabilities (Amsteus, 2011; Horton, 1999; Rohrbeck, 2010). Presumably, this may be accounted for by different scholars focusing on different facets of the concept (Amsteus, 2008). Due to the cross-functional character of organisational foresight, the research on it has typically been followed by scholars from different research disciplines, including strategic management, technology and innovation management, and futures research.

Organisational foresight as a capability. This study contributed to the development of the organisational foresight construct by applying the theoretical frames of evolutionary economics (Nelson and Winter, 1982), dynamic capabilities (Teece et al. 1997, 2007) and organisational learning (March, 1991), all of which are based on the theoretical foundations outlined in a behavioural theory of the enterprise (Cyert and March, 1963). It has been shown how these perspectives may be deployed to contribute to the definition of organisational foresight, as well as how they may be deployed to specify the theoretically presumed relationship between organisational foresight and innovation. More specifically, organisational foresight was presented as

a *capability* which enables organisations to deal with uncertainty in their everyday situated activities. This capability provides means for the creation, exploration and exploitation of long-term competitive advantage in fast-moving environments characterised by great uncertainty. Hence, this dissertation took a stance that instead of viewing foresight as a clearly separated exercise outside the firm's day-to-day activities, it should be seen as a capability (or set of capabilities) *embedded* in the firm's strategic activities, thus involving a much larger proportion of the organisation and making individuals responsible and accountable for forward-looking activities through traditional processes such as new business development processes and corporate entrepreneurship. Organisational foresight was defined as an ability that includes environmental scanning, strategic selection and integrating capabilities enabling the firm to detect discontinuous change early, interpret the consequences for the firm and formulate effective responses, while at the same maintaining a high-quality, coherent and functional forward view. If well managed, organisational foresight capabilities could help in creating and capturing value from continuous and discontinuous change. From this perspective, organisational foresight is viewed as a crucial organisational practice that takes place at the micro-level, a shift from a technical–rationalistic episodic activity to a socially embedded process-based and permanent capability (Cunha et al., 2006).

An alternative approach with regard to defining organisational foresight concerned the classification of foresight as a competence or behaviour rather than as a capability. The arguments are provided next. Firstly, competence is generally seen as a concept in the field of leadership, which includes knowledge, skills, attitudes and behaviour of individuals. Thus, a competences model would describes the behaviours and skills of employees or managers required to excel and succeed, in other words how an organisation desires their people to interact and behave. Whereas a capability model tends to measure organisational attributes rather than people attributes, so is more suitable for the purposes of this study which takes the perspective of an organisation. Secondly, behaviour only focuses on the current/existing operational activities that an organisation or its employees are performing. From the evolutionary perspective, the interest is in the enterprise wide activities and routines (capabilities) describing a range of organisation behaviours and evolving over time. Capability focuses on current and also any potential behaviours that an organisation may be able to perform. Capabilities hence are collections of high-level, learned, patterned,

repetitious behaviours that an organisation can perform better relative to its competition (Nelson and Winter, 1982; Winter, 2003). Further, capabilities decompose business by purpose (e.g. goals and outcome), whereas behaviour or functions decompose business by activity. Evolution of the business environment and intrinsic organisational traits (like organisational culture) are behind why individuals and organisations behave the way they do in a given situation. Thus, appraising foresight as a competence or behaviour, for example, when testing a possible relationship with innovation, would omit the evolutionary approach. Consequently, classifying foresight as a set of capabilities was deemed the most appropriate approach. The capabilities literature extends and complements the resource based view with the provision that in order to achieve value, the enterprise not only needs to secure relevant resources but also needs to develop corresponding capabilities (Helfat and Peteraf, 2003; King and Tucci, 2002).

The study accepted Rohrbeck's (2010) understanding of organisational foresight as an intrinsic organisational capability, but also expanded the Rohrbeck's model by adding conceptual suggestions proposed by Amsteus (2011), Bishop et al. (2007) and Grimm's (2009) foresight maturity model, which is based on the steps of scoping, forecasting, visioning, planning and acting. This dissertation advocates for an *integrative approach* to organisational foresight as an everyday practice, where foresight methods, processes and competences are not mutually exclusive - a process can contain a series of methods, and methods and processes can be used to achieve a capability. Thus, the conceptual model of organisational foresight took into account all key elements of foresight (methods, process steps and organisational traits such as organisational culture - coordination and leadership) tying the different research streams together.

Beyond environmental scanning: strategic selection and integrating capabilities. Recent theorising within the fields of entrepreneurship and strategy has increasingly revolved around the concept of entrepreneurial search and entrepreneurial opportunity (Salvato et al., 2004). Discussion on entrepreneurial search suggests that a competitive landscape with substantial uncertainty, mainly due to discontinuous change of technologies and globalisation, continuously opens and closes windows of opportunity (Ireland and Hitt, 1999). A focus on how firms adapt to environmental change and exploit opportunities created by such uncertainties and discontinuities in the creation of greater performance is also the main tenet of strategic

management. Research investigating firm adaptation through the pursuit of entrepreneurial opportunities have converged toward a view of opportunities as those situations in which new products, services, raw materials, and organising methods can be introduced and sold at greater than their cost of production (Salvato, Sciascia, Alberti, 2004). These opportunities are seen as existing because there exist asymmetries of (a) information available to different economic agents, and (b) their different abilities to access, store information both from inside the organisation and from outside sources, recognise the value of new information, assimilate it and apply it to processes of innovation.

Extensive research on the sources of innovation supported the view that outside sources of knowledge are critical to the opportunity recognition process (von Hippel, 1988). Hence, it is a frequent assumption of evolutionary theories of innovation or organisational change that local search significantly restricts the course of innovation (Stuart and Podolny, 1996). Search activities may be delineated as activities that scan the external environment in order to find either alternatives to existing routines or new routines (Saviotti and Mani, 1998). From an evolutionary perspective, organisational foresight has been called part of the search and change strategy, or even a dynamic capability as such (Rohrbeck, 2010), and environmental scanning for entrepreneurial opportunities is one of its key elements.

However, this study noted that previous research has often limited foresight to environmental scanning. At the same time, tt has been acknowledged that implementation of organisational foresight systems remains limited (by e.g. Day and Schoemaker, 2005; Becker, 2002; Reger, 2001; Daheim and Uertz, 2008; Rohrbeck, 2010) as building an organisational structure that facilitates an effective response proves challenging. As noted above, value-creating scanning capabilities do not only derive from access to new knowledge, but are particularly dependent on *how* new knowledge is analysed, exploited, integrated and coordinated within organisations (Teece et al., 1997; Rohrbeck, 2010). Hence, building on Bishop et al. (2007) and Rohrbeck (2010), this study suggested that companies require also *strategic selection* (analysing, visioning and planning) capabilities to make better use of new knowledge and to be able to effectively incorporate external knowledge into their own innovation processes. Organisational foresight can thus be regarded as a *process* of collecting, interpreting and assimilating future related environmental information derived from external sources. Organisational learning perspective provided knowledge on what

capabilities are required in the process for successful transfer and usage of the generated insights. On the other hand, the operationalisation of strategic selection capabilities foresight also took into account that foresight is also a *proactive step* for coping with uncertainties in the business environment - not just as an environmental information gathering process, or a reflection and knowledge generating process, but also a vision-building and direction-setting process (Daheim and Uertz, 2006). Capabilities such as Visioning are necessary to justify the above aims.

Finally, this dissertation proposed that firms need enabling or *integrating* organisational capabilities to strategically select, transfer and exploit environmental information generated from various external sources and synthesized via the internal strategic selection processes. Such integrating capabilities are important enablers of the diffusion of foresight results. Literature associates integrating capabilities with internal organisational culture and the human component, which can to some extent act as a substitute for formal foresight processes. Several authors in their empirical studies suggested that cultural barriers, for example, lack of incentive to think about the future and to question underlying assumptions, the 'peripheral vision' of managers and lock-in of their mental models (Day and Schoemaker, 2005), or lack of sharing across functions (Rohrbeck, 2010; Day and Schoemaker, 2005), are blocking the implementation of foresight results. Hence, the more firms coordinate, integrate, and maintain externally sourced knowledge, the more likely it is that they will be assimilated into high-performing innovation capabilities. The dissertation proposed that the capabilities required to integrate generated knowledge are captured by the underlying capabilities of leadership and coordination.

However, integrating capabilities are also path-dependent. Previously obtained knowledge base and existing learning capacities puts bounds around what types of new knowledge can be exploited. Following the argument of Cohen and Levinthal (1990) it is enterprises with higher knowledge base are more likely to establish linkages and gain the most from the external sources of knowledge. Knowledge base term was accepted by this dissertation, although it could also be called learning capacity or learning capability. It was noted that different organisational learning research streams call this capability differently. For example, one of the merging influential concepts in the organisational learning literature is one of a learning organisation (Senge, 1990). The basic rationale is that in situations of rapid change only those organisations will excel that are flexible, adaptive and productive. For this to happen, it is argued,

organisations need to ‘discover how to tap people’s commitment and capacity to learn at all levels’ (Senge, 1990, p. 4). To create the capacity to learn at all levels, an organisation needs to develop appropriate and systemic structures, capabilities and tools. Literature is vast with suggestions on how to create learning organisations. This dissertation did not aim to analyse the tools, structures and competences required to build this learning capacity, but it took the key elements (stock of educated and experienced employees, R&D efforts and continuous organisational learning) to compose a knowledge base’s scale. This scale could be further developed by future studies, taking into account knowledge on learning organisations able to best capture the value from external and internal information.

In summary, the strength of an organisation’s integrating capabilities in this dissertation was determined by leadership, coordination and knowledge base. It is proposed that these capabilities are critical for creating organisational culture which promotes trust, openness, encourages vertical and horizontal communication, essential in supporting information gathering and rapid insight diffusion.

The review of literature concluded that organisational foresight research is still driven by the aim to identify successful methods and processes. To enhance the maturity of organisational foresight research and to move closer to theory development and further on to theory testing, a common framework with its constituting elements was needed. A formative second-order conceptual framework, which constitutes a coherent and parsimonious depiction of the multidimensional nature of organisational foresight, was proposed. It focuses on three groups of higher-order capabilities at the most comprehensive analytical level: (i) environmental scanning, (ii) strategic selection and (iii) integrating capabilities. They are core concepts in two streams of relevant research: foresight (e.g. Slaughter, 1996; Bishop *et al*, 2007) and dynamic capabilities (Teece, 2007). Second-order model was suggested as foresight capabilities reside at a higher level of abstraction than their underlying processes or activities. The existence of organisational foresight capabilities cannot be assumed without specifying the particular routines that are crucial for the development and deployment of capabilities. Drawing on literature, ten specific underlying sub-components (usage of strong tie sources, usage of weak tie sources, time horizon, depth of scanning, analysing, planning, visioning, leadership, coordination and knowledge base) were identified that put organisational foresight into use. These capabilities may not exhaust

all factors that enable the specified second-order capabilities, but they are posited as representative of existing literature.

The model proposed and tested by this study is an important step towards developing testable constructs and hypotheses and thus leading the transition to deductive research and theory testing. Organisational foresight construct has been defined precisely enough to allow quantitative measures to be developed. The definition is more delineated than previous definitions. It has been shown how the construct was created and it is concluded that it is possible to define foresight in this manner. In distinguishing basic elements of foresight, the dissertation advances foresight as a distinct construct that can be related to various research fields at organisational level. Establishing organisational foresight as a capability means that some groundwork has been laid. It permits a more unified research approach, and thus the promotion of future progress in the discipline.

6.2. Development and testing of the measurement scales

One of the key contributions of this dissertation was development of an instrument for measuring organisational foresight. It is one of the first attempts to create valid and reliable scales for measuring organisational foresight. It has been shown how the instrument was created and it is concluded that the instrument is acceptably reliable and valid. The face validity of the content was ensured, so was the convergent and discriminant validity of the construct by applying tests of Cronbach's alpha and exploratory as well as confirmatory factor analysis. Organisational foresight can now be assessed and tested for relationships and interaction with other variables. Since it is one of the first scale development attempts, there is much scope for improvement. The validation procedures should be further completed and the measurement instrument can be improved.

Since no similar scale development studies were completed before this dissertation was finalised, it is impossible to compare and discuss the results of validation procedures with the results achieved by other authors. Therefore, this sub-chapter focuses on discussing how validity issues were approached in this research.

Nunnally and Bernstein (1994) have contended that there is essentially only one type of validity – *construct validity*, as there is no distinct border separating test content and construct, which is the extent to which a measure performs in accordance with its theoretical expectations (Carmines and Zeller, 1979). Hence, it should be noted that

strict discriminations among the validity forms (construct, content, predictive validity etc.) are impossible, and evidence collected relevant to one form is usually relevant also to the other forms (Amsteus, 2011). Based on the above, the present dissertation did not distinguish the forms of validity, and focused on construct validity. It tested several criteria of construct validity: theoretical and observational meaningfulness of concepts (content), internal consistency of operationalisations, and convergent as well as discriminant validity (Bagozzi, 1976). To ensure construct validity, several methodological steps were performed. *First step,* stemming from literature analysis, was the specification of the domain of content and building an extant review of the concept helped to construct a measurement instrument covering key organisational foresight content domains (construct definition). *Second,* face validity of both the academics assessing the questionnaire (is it measuring what it is supposed to measure) and potential respondents (are the questions understandable) further improved the construct validity – its theoretical and observational meaningfulness.

Third, the development of the questionnaire focusing on (a) Likert-type scales that (b) each had at least three items per variable (in many cases – more items to ensure flexibility if items had to be dropped in later stages) also contributed to the validity enhancement. An alternative approach with regard to developing a foresight measurement instrument concerned the choice of the 57 preliminary and the resulting 32 final Likert-type items making up the organisational foresight instrument. As there is no precise method for outlining the domain of variables for a construct correctly (Nunnally and Bernstein, 1994), and there are indefinite and at times contradictory rules of good practice (Marsh et al., 1998), a number of options were considered. While it would have been possible to regard each item on the scale to be a separate dimension or aspect of the construct (on its own), the idea of the summated rating scale is that several items are combined rather than analyzed individually (Spector, 1992). Multiple indicators for each construct are preferred (Nunnally and Bernstein, 1994). At least two indicators should be employed for each estimated construct and each indicator should in turn be intended as an estimate of only one construct (Gerbing and Anderson, 1988). Importantly, the construct validity should be unaltered if a reflective indicator is dropped (although the reliability coefficients, such as Cronbach's alpha of the collection of items will decrease) (Jarvis et al., 2003). Consequently, the choice of multiple Likert-type items was deemed the most appropriate approach (rather than, for example, only the two foresight items). Likewise, there are well-founded

arguments for this or why, for example, separate yes or no questions are insufficient (Gerbing and Anderson, 1988). Such questions are notoriously unreliable. They are imprecise because they restrict measurement to only two levels with no way to distinguish within each level. They lack in scope. Many measured characteristics are broad in scope and not easily assessed with a single question. In contrast, employing several response choices and multiple items increases reliability, precision, and scope (Spector, 1992).

Fourth, construct validity was examined using an exploratory factor analysis technique to determine that the factor structure is suitable. Based on EFA results, the 32 items measuring organisational foresight were reduced to eight factors instead of ten anticipated factors. The 8 items of ambidextrous innovation were reduced to two factors, all as anticipated. Factor analysis suggested 6 items for removal. From the EFA results, the study found that all the item loadings on first-order factors exceeded the required minimum of 0.6. The scales of Coordination and Leadership were merged into one scale called Coordination, which is acceptable given the theoretical considerations (leadership also means good communication and coordination of organisation's mission and values). The scales of Visioning and Planning were merged into one scale called Visioning, which is also acceptable given the theoretical considerations (planning helps incorporating vision into organisation's strategy and measuring how effective the activities are in implementing organisation's vision). The factor analysis verified the scales of Weak tie sources, Strong tie sources, Time horizon, Depth of scanning, Analysing, Visioning, Coordination and Knowledge base to be the appropriate factors for the research. All theoretical dimensions of organisational foresight capabilities and ambidextrous innovation were represented by 3-6 items.

Fifth, examination of internal consistency of the items using Cronbach's alpha yelded additional evidence of construct validity. Cronbach's alpha reliability scores for analysing, visioning and coordination (on the final scales after EFA) were over 0.8, which is considered very good (Hair et. al. 1998). Cronbach's alpha reliability scores for strong tie sources, weak tie sources, time horizon and depth of scanning were between 0.616 and 0.749, which is considered good. Hence, the results demonstrate that the questionnaire can be considered an adequatelly reliable measurement instrument. Cronbach's alpha reliability score for knowledge base was between 0.5 and 0.6, which shows that the reliability of this scale is weak according to Hair et al

(1998). Although the knowledge base scale of three items was used for further statistical analyses in this study due to its theoretical value, this scale's validity could be further improved.

Finally, confirmatory factor analysis (CFA) and model fit tests using structural equation modelling (SEM) were performed. However, validation with SEM techniques was limited due to the insufficient sample size. The recommended sample should allow from 10 to 20 observations or cases per measured parameter. Also SEM requires at least 3 manifest variables for each latent factor. Moreover, the more complex is the model (the more of manifest variables), the larger the sample should be, otherwise two persistence estimation problems likely to occur: non-convergence and improper solutions. SEM is based on covariances and covariances are less stable when estimated from small samples. Parameter estimates and chi-square tests of fit are also very sensitive to sample size (Ullman, 2006). Hence, SEM is a large sample technique and is in generally not recommended when the above-listed conditions are not met. Based on the above, CFA and model fit tests were not performed on the full model, and only two-factor CFA's were completed. Since EFA showed that Strategic selection and Integrating capabilities each consist of two variables (Analysing and Visioning, and Coordination and Knowledge base), SEM techniques for these second-order factors could not be performed.

Confirmatory factor analysis showed good fit statistics for the *Weak tie sources, Strong tie sources*, *Analysing, Visioning* and *Coordination* scales. Factor loadings of these scales showed sufficient variance and converged on the factors as expected. CFA indicated a relatively high covariance between Strong and Weak tie sources, and between Analysing and Visioning, which could be a sign of convergent validity as both these factor groups belong to the same second-order factor (Environmental scanning and Strategic selection). Two factor loadings of items B2 and B3 on the factor Strong tie sources were lower than the rest of factor loadings, hence these items were eliminated from further analysis.

The CFA procedure for the scales of *Depth* and *Time horizon* was not completed, hence the full validation of these scales is yet to be performed, better with larger samples. Also, the scale of *Knowledge base* showed comparatively poor factor loadings as expected after the internal consistency checking with Cronbach's alpha (although EFA results were acceptable). Hence, the reliability and validity of this scale could be further improved.

CFA for the second-order factor *Environmental scanning* was completed, using four manifest variables (Strong tie sources, Weak tie sources, Depth of scanning and Time horizon), calculated as the average scores of separate items. The fit statistics indicated acceptable fit (chi square 4.95; 2 degrees of freedom; p value 0.0844; RMSEA 0.080; CFI 0.969). The analysis indicated somewhat lower loadings of Depth and Time horizon on Environmental scanning (0.45 and 0.55 respectively, compared to 0.74 for Strong tie sources and 1.0 for Weak tie sources).

Further it was tested how the items load on the second-order factor *Strategic selection*. Since CFA requires at least three manifest variables per latent variable, CFA with only two (Analysing and Visioning) latent variables was not possible. The fit statistics indicated a good fit. A similar CFA procedure for *Integrating capabilities* also indicated a good fit. The factor loading for item H3 belonging to Knowledge base was poor, contributing to the previous examination of the Knowledge base scale.

The validation techniques employed ensured that (a) the criteria of the theoretical and observational meaningfulness of the concepts were met, (b) internal consistency of operationalisations was acceptable (only the reliability of Knowledge base scale could be further improved), (c) convergent validity was acceptable in case of seven out of ten scales (Depth and Time horizon should be further validated, and the scale of Knowledge base should be improved). In summary, it was concluded that the reliability and validity of the proposed model can be deemed satisfactory at this stage, although the validity assessment of some scales (especially Depth and Time horizon) is only partially completed and should be further tested with larger samples in future multi-method studies. Without the scales which validation is only partially completed the organisational foresight construct would lose its theoretical meaningfullness. The eight OF first order factors ensure that the questionnaire reflects key dimensions of organisational foresight as it was anticipated in the theoretical analysis. The importance of company's ability to scan its environment deeply and to focus on the time horizon from short to long term has been stressed by many foresight scholars (e.g. Becker, 2002; Day and Schoemaker, 2005; Jain, 1984; Rohrbeck, 2010; Reger, 2001; Lichtenthaler, 2002). Hence, these scales were accepted for hypothesis testing.

The *sum score method* was chosen to compute organisational foresight factor scores for hypothesis testing. Sum scores method allowed creating the second-order and third-order indexes of organisational foresight and its dimensions required to test the hypotheses. Cronbach's alpha for the organisational foresight was 0.802, which

indicates good internal consistency. Cronbach's alphas for environmental scanning, strategic selection and integrating capabilities indexes ranged from 0.623 and 0.801. Index creation (formative approach) versus scale creation (reflexive approach) has been discussed by several scholars (see e.g. Amsteus, 2011, Diamantopoulos and Siguaw, 2006). The most prevalently used model-design is reflexive, but a number of studies have found constructs which have incorrectly been operationalised as reflective (Amsteus, 2011, p.51). Moreover, there are only rare examples when the chosen approach is explicitly motivated (Diamantopoulos and Siguaw, 2006), while in fact data imply that managerial constructs in the marketing discourse are more often formative than reflexive in character. Importantly, incorrect specification of the measurement model can affect the conclusions with regard to the relationships between latent constructs (Jarvis et al., 2003). The methodological guidelines with regard to the first part of measure development (item generation) are similar for both approaches, and this may be equally or even more important with regard to index construction, where the indicators have to cover the whole range of the latent variable in accordance with the content description. Moreover, the factor scores following e.g. exploratory factor analysis (EFA) have several risks. For example, factor scores may be skewed and/or non-normal, especially if non-refined methods were used to create the scores. Further action (e.g., transformations) may be needed before using factor scores in subsequent analyses. Failure to properly screen the factor scores may result in results of hypothesis tests that could provide misleading or even incorrect information (DiStefano et al, 2009). Hence, should the factors resulting from EFA had been used to create the indexes, the weighting among the items would have been skewed compared to the theoretical definition of organisational foresight and organisational ambidexterity (the items in the factors resulting from the exploratory factor analysis were not equally distributed on the theoretical sub-components).

In developing and estimating the instrument for measuring organisational foresight, the dissertation attempted to advance organisational foresight into a quantitatively measurable concept. The proposed instrument can be deployed in various research contexts. The results of validity assessments allow proposing which parts of the measurement instrument should be further validated. The full measurement instrument could be further tested with larger samples in future multi-method studies.

6.3. Foresight and ambidexterity in Lithuanian manufacturing companies

Through descriptive statistics, the study found the average scores of organisational foresight capabilities in Lithuanian manufacturing companies (on average, 4.52 in the 7 point scale). Descriptive analysis shows that, on average, the Lithuanian manufacturing firms are regularly in contact with the strong tie environmental scanning sources (working with customers and suppliers, participating in industry conferences, trade shows) - the overall score on the usage of strong tie sources (mean of 5.63 on the 7 point scale) was the highest of all organisational foresight dimensions. On average, manufacturing firms reported that they have quite developed coordination (5.54) and visioning (4.99) capabilities, which may also mean that their organisational culture and leadership is rather open for the wider vision. However, the study found that the Lithuanian manufacturing companies use weak tie scanning sources (e.g. patents databases, contacts with the research community, and surveys of experts) to a very limited scale - the overall score of regularly using the weak tie sources (3.20) was second lowest of all organisational foresight dimensions. Only the degree of acquired knowledge base, e.g. educated workforce and continuous organisational learning, was lower (3.03). The overall scores on time horizon, depth of scanning and analysing were in the middle (between 4.24 and 4.64).

Given that company managers tend to rank their company results or capabilities higher (more positively) than they actually are, the state of organisational foresight capabilities may be between moderate and mediocre. These capabilities could be further examined with the means of qualitative research in order to explain the results received by quantitative survey. Probably, low contacts with weak tie sources and limited learning capacities (internal knowledge base) can be explained by the structure of Lithuanian industry, which dominated by small and medium companies operating in low tech industries. Companies having below 50-250 employees and operating in low technology industries constituted 80% of all companies in Lithuanian industry and about the same in the final survey sample. Smaller companies tend to collaborate more with their typical business partners (strong tie sources), whereas companies operating in low technology sectors are typically less interested in cooperation with the scientific community. Some of these companies are not even producers of their own product or brand – they simply sell their capacities to product developers from other countries, or provide assembling services. Also, it has to be taken into account that this survey was

carried out in a country described as a catching-up or latecomer economy with a specific national context related to innovation, cooperation and forward thinking (Radosevic and Reid, 2006). Varblane et al. (2007) suggested that there are serious obstacles for systemic innovation efforts in a catching up economy (reflections of path-dependency), for example:

- Confrontation between high- and low-tech industries;
- Lack of social capital and network failures;
- Weak innovation diffusion system and low motivation to learn.

Paliokaitė (2013b) notes that, given the historical separation of science and industry and the prevailing differences in culture, a lack of productive collaboration between the industry and public research sectors is nowadays one of the most challenging issues in the Lithuania's innovation system. In spite of the current policy effort to strengthen science-industry links, deficiencies are present on both sides – poor commercialisation endeavour and a lack of commercially-valuable results in the academy, on the one hand, and low ability to look outside the short term company's horizon, to identify and exploit external knowledge, on the business side. Information asymmetry, lack of motivation from both sides and sometimes too rigid setting of public policies only reinforce the weaknesses mentioned above. An innovation oriented culture and skills are not yet developed at the Lithuanian universities and public research institutes. They are also weak in marketing their research and existing capabilities to the business sector.

As noted above, the divide between high technology and low technology is important for innovation outcomes. This dissertation assumed that the largest group (smaller companies operating in low technology sectors) may be least innovative and having lowest organisational foresight capabilities, but there could be groups of high tech sectors that are both more innovative and foresighful. So the companies were grouped into 4 groups in order to have a good representativity of the different industry sectors (based on their R&D activity) and company sizes. Grouping was based on the Statistical Classification of Economic Activities in the European Community (NACE) at 3-digit level. Descriptive statistics partly confirmed these assumptions showing that companies *having 50-250 employees and operating in high – medium high technology industries* have on average the highest degree of organisational foresight index (4.94, compared to the average of 4.52 in the overall group), followed by larger companies (having above 250 employees) and operating in the low-medium low technology

industries (4.85). The first group of companies used the weak tie sources more extensively, and their overall knowledge base was higher.

Although this dissertation did not confirm the statistical significance of company size for organisational foresight results, previous research note that small innovative companies, especially from high technology sectors, are also more collaborative. According to Huggins et al. (2010), they are more often involved in knowledge sourcing because they lack the critical mass of capacity to perform internal R&D. A vast variety of emerging studies advocate for a practice that has been labelled 'open innovation' (Chesbrough, 2003) and is regarded as the hallmark of innovative enterprises. The ways by which enterprises innovate has evolved into a more open system (Chesbrough, 2003), the internal knowledge development has been expanded into and partially substituted with external knowledge sourcing. Since SMEs innovate through more collaborative means, they participate in so called knowledge or innovation networks (Vonortas, 2009), where the sole value of knowledge received is strengthened by the value of relationships created in the knowledge sourcing process. Being better linked and thus participating in denser networks is related to increased innovation performance of enterprises (Fleming et al., 2007; Fukugawa, 2006).

Interestingly, the descriptive analysis of empirical research results showed that, on average, the organisational foresight capabilities in *large companies (having above 250 employees) operating in the low-medium low technology industries* were also relatively strong. This finding may probably be explained by fact that the most prominent sectors in the Lithuanian industry are the traditional ones, i.e. operating in low-medium low technology sectors (like food industry), accounting for the largest share in value added, employment and leading in the Lithuanian exports (Martinaitis et al., 2013). Large companies operating in these industries are older and more experienced. Also, they are currently facing serious dilemmas related to their future competitiveness as the prevailing strategy, which is still dependent on low costs, is losing its attractiveness with the increasing cost of labour, energy and raw materials (Paliokaitė and Martinaitis et al., 2013). To sustain competitiveness the low - medium low tech sectors face the inevitable need to restructure and move towards new business fields, diversify and modernise. The recent economic crisis only made this challenge more evident. It can only be assumed that in the face of the described challenges the 'current locomotives' of the Lithuanian economy (according to

Martinaitis et al., 2013) became more active in considering their alternative futures, challenging basic assumptions and developing foresight capabilities.

The empirical research results found that Lithuanian manufacturing firms, on average, tend to pursue ambidextrous innovation strategies and typically focus on both explorative and exploitative innovation at the same time. *The focus on exploitative innovation is on average much stronger* – the overall score on the exploitative (incremental) innovation was 5.74, and the score on explorative innovation was lower (4.82). Companies operating in high and medium high technology sectors were focused on explorative innovation more than those which operate in low – medium low technology sectors, although the score difference was not substantial. Interestingly, large companies (above 250 employees) operating in low-medium low technology sectors scored highest in terms of both explorative and exploitative innovation.

Statistical non-parametric tests found support to the proposition by Day and Schoemaker (2005) and Rohrbeck (2010) that *organisational foresight capabilities are stronger in those companies that face higher technological turbulence in their environment*. Moreover, access to external financial aid also made a significant difference. On average, those companies that had attracted external aid (either loans, or subsidies, risk capital) for innovation, also had stronger organisational foresight capabilities and higher scores for explorative and exploitative innovation. This could mean that (a) either access to external financial aid serves as a push for additional investments into innovation and organisational foresight capabilities, or (b) companies that have higher organisational foresight capabilities are also more successful in attracting external aid for innovation development.

6.4. The relationship between organisational foresight and organisational ambidexterity

Empirical evidence on foresight – ambidexterity relationship. Organisational foresight has been discussed as a proactive, opportunity-seeking, forward-looking perspective (Ahuja and Lampert, 2001). Portrayed as an entrepreneurial search process it reflects a posture of anticipating and acting on future changes in the market (Baker and Sinkula, 2009), which may lead to pioneering new methods, techniques, and products. Although it may seem that organisational foresight as an entrepreneurial orientation merely encourages the search for new options in order to benefit from unexplored opportunities, it was suggested that foresight can also provide a favourable

setting for product development exploitative capabilities (incremental modifications and improvement of existing products) to grow (Rhorbeck and Gemuenden, 2011).

The proposition that organisational foresight can contribute to organisational ambidexterity – ability to pursue both explorative and exploitative innovation (Jansen et al., 2006) - is the focal point of this study. According to March (1991), organisation's long-term success depends on its ability to exploit its current capabilities while simultaneously exploring fundamentally new competencies (March, 1991). Exploration is captured by the terms of search, risk taking and discovery and refers to radical innovations that are designed to meet the needs of emerging customers and markets (Danneels, 2002). Hence, exploration departs from existing knowledge, while exploitation refers to incremental innovations that are designed to meet the needs of existing customers or markets (Jansen et al., 2005). The challenge for firms is to both ensure current activities are run efficiently to satisfy the short term demands and be prepared for the future to retain long term competitiveness.

Understanding how to achieve ambidexterity through organisational antecedents however is still limited. The research by Middelbeek (2010) showed that environmental scanning is positively and significantly related to ambidexterity, especially to explorative innovation. Rohrbeck and Gemuenden (2011) suggested that foresight contributes to ambidexterity by following three roles – initiator, strategist and opponent. This study deployed a proposed measurement instrument in a quantitative survey to test this theory, and *positive statistically significant relationships between organisational foresight and ambidextrous innovation has been found*. The regression analysis results indicated that organisational foresight had a moderate positive relationship to both exploitative and explorative innovation (beta = 0.634 for explorative innovation and beta = 0.647 for exploitative innovation). The results of linear regression between organisational foresight and sum-ambidexterity are even better – beta is 0.713, and organisational foresight accounts for about 50 percent of organisational ambidexterity. The results showed that all three dimensions of organisational foresight (environmental scanning, strategic selection and integrating capabilities) have a positive relationship to both exploitative innovation and explorative innovation. The reversed relationships (if ambidextrous or innovative companies also have higher organisational foresight capabilities) were not tested and can be further investigated by future studies.

In providing empirical support for the theoretical association between foresight and ambidexterity, the dissertation advances evidence for the importance of organisational foresight. Importantly, the empirical evidence for the relationship between organisational foresight and organisational ambidexterity lends confidence to the definition developed and the instrument deployed. A literature review on revealed that literature on organisational foresight is quite extensive with respect to normative arguments about strengths and success of organisational foresight in contributing to innovation (at least 20 recent related studies have been found). However, studies that empirically test and quantify the relationship between foresight and innovation appeared nearly non-existent. Therefore, the contribution of this dissertation in supporting the theoretically assumed relationship between organisational foresight and organisational ambidexterity is one of the first. The empirical results confirm the propositions of German foresight scholars Rohrbeck and Bade (2012), Rohrbeck and Gemuenden (2011). The results of this dissertation serve as empirical basis and encouragement for further research in this direction.

The roles of second-order capabilities. Most research concerning the relation between organisational foresight and innovation has focused on radical, explorative innovation (e.g. van der Gracht, 2011). However, the results of this study showed that *the positive relationship between organisational foresight and explorative innovation was similar, and even a little bit weaker, than the positive relationship between organisational foresight and exploitative innovation*. In principle, the strength of the relationships between the three second-order foresight dimensions and the two types of innovation were found to be as it was theoretically assumed. For example, it was suggested, based on Rohrbeck and Gemuenden (2011) and Danneels (2008) that *environmental scanning capabilities play a leading role when fostering explorative innovation*. The role of strategic selection capabilities (especially, visioning) and integrating capabilities (especially leadership, in the adjusted measurement instrument – coordination) should also play a secondary role. Based on Rohrbeck and Gemuenden (2011) it was proposed that foresight here mainly plays initiator's role and encourages innovation ideas generation, scans for disruptions that could endanger current and future innovations, generates new innovation initiatives, including new R&D projects and new process or business model innovations, and also plays strategist role by creating and communicating vision. These theoretical propositions were confirmed by empirical evidence. Environmental scanning had the strongest

positive relationship to explorative innovation (beta = 0.649, compared to 0.507 (integrating capabilities) and 0.481 (strategic selection)) compared to strategic selection and integrating capabilities. However, environmental scanning was only weakly associated to exploitative innovation (beta = 0.436). It can be explained by the nature of environmental scanning delineated as search activities that scan the external environment in order to find either alternatives to existing routines or *new* routines.

Further, it was theoretically assumed that *in the relationship between foresight and exploitative innovation integrating capabilities play a leading role*. Environmental scanning and strategic selection (especially analysing) capabilities should also play secondary roles. Rohrbeck and Gemuenden (2011) proposed that organisational foresight in this relationship plays roles of opponent and idea evaluator, encourages to create better and more successful innovations by challenging basic assumptions, and challenges the state-of-the-art of current R&D projects. These theoretical propositions were also empirically supported. Integrating capabilities had the strongest positive relationship to exploitative innovation (beta = 0.630, compared to 0.543 (strategic selection) and 0.436 (environmental scanning)) compared to strategic selection and integrating capabilities.

First-order organisational foresight factors and explorative innovation. In summary, all the organisational foresight first-order factors had statistically significant relationships to explorative innovation. The strongest contribution was of: (i) Visioning (beta equals 0.345), (ii) Strong tie sources (0.326), (iii) Knowledge base (e.g. R&D investments, employees' education and continuous organisational learning) and Coordination activities (including the role of leadership in challenging the existing assumptions and creating incentives for wider vision) – each 0.288, and (iv) Weak tie sources (0.233). Analysing, Depth of scanning and Time horizon contributed to a lower extent (betas ranged from 0.177 to 0.213).

The results of regression analysis, analysed separately for first-order factors (dimensions) or organisational foresight and explorative innovation, provide several important insights. Firstly, the results show that of all the environmental scanning dimensions scanning the *Strong tie sources* (e.g. regular contacts with suppliers, customers, and participation in trade shows) has the strongest relationship to explorative innovation, followed by the *Weak tie sources* (e.g. experts, researchers, patent' databases).

Surprisingly, these results do not confirm the Granovetters (1982) theory that weak ties in contrast to strong ties are more effective in giving access to conceptually novel information. It was assumed that the contacts with weak tie networks, which are further removed from the usual behaviours of entrepreneurs and provide weak signals that, while difficult to grasp and decode, nevertheless offer new, pre-competitive information that can support radical innovations. Julien, Andriambeloson and Ramangalahy (2004) tested the probability of this theory conducting of a survey involving 147 SMEs in the land-based transportation equipment sector and confirmed the importance of weak tie networks as opposed to other types of networks, recognising their complementary contribution to technological innovation.

Past research on innovation is also consistent in distinguishing universities and other public research organisations as potential sources of innovation. Enterprise-university collaboration ventures represent a special type of organisational collaboration. Pavitt (1984) regarded some industries to be 'science-based', indicating that scientific knowledge is among the main sources of opportunity identification and exploitation. In this context, a vast and still growing literature stresses the importance of university linkages for innovation, also in small enterprises (e.g. Elfring & Hulsink, 2003), although several studies (e.g. Leiponen, 2001; Cassiman, 2005) demonstrated that larger enterprises having better developed research skills are more interested to engage in relationships with public research institutions. Enterprises from high tech industries concentrate more on problem-solving in core technological areas through technology transfers and collaborative research with universities (Santoro and Chakrabarti, 2002). Looking directly at the benefits of enterprise-university collaboration, namely at the impact of high level scientific output on patents, Gittleman and Kogut (2003) find that publications, collaborations, and science intensity are associated to patented innovations; however, important scientific publications are negatively associated to high-impact innovations. Hence, empirical results on industry-science collaboration provide mixed results and suggest that the ‘black box’ of these relationships needs to be investigated taking into account different contexts where collaboration takes place. Nevertheless, the dominating opinion is that innovation results of weak tie collaborations are expected to be more substantial that the results of strong tie collaborations. The question is why empirical results of this dissertation showed the opposite.

From the one hand, it can be assumed that either the Lithuanian universities or their researchers are still too distant from technological disruptions and emerging market needs, or the knowledge base (absorptive capacities) in the Lithuanian manufacturing companies is too weak to recognise the value of new knowledge gained from the weak tie sources such as networks with research institutions. The research findings may point out to the existing weaknesses in the Lithuania's innovation system, that are typical to a catching-up economy and are characterised by (a) mediocre science base, which is rather closed from the world scientific knowledge, international science networks and emerging global trends, is focused mainly on basic science and lacks commercialisation oriented culture, (b) lack of motivation for industry-science relationships and huge information asymmetry, and (c) weak absorptive capacities in the indigenous manufacturing companies mainly due to the prevailing strategies still based on low cost rather than on higher value added products (Paliokaitė, 2013b).

On the other hand, it can also be assumed that since Lithuanian manufacturing industry is dominated by small companies, these companies tend to collaborate more intensively with suppliers and 'coopetitors', and by doing so they are more successful in creating critical mass of R&D and innovation efforts. Conventional thought suggests that innovators need wide-ranging, weak ties across distant worlds to be inspired to innovate, and strong ties to mobilize support for their emerging innovations (e.g. Ahuja, 2000). Also, few existing case studies carried out on innovation in Lithuanian industry, emphasize the role of foreign suppliers in triggering innovation. This can be illustrated with an example of BOD Group – a company that produced compact discs (CDs) and has now switched to producing solar cells. When facing the closing business market, BOD Group was looking for a new business practice, where it could use and expand its industrial, commercial and marketing skills. The sector of solar (PV) energy was chosen because of its technological proximity to the sector of optical equipment, the company's original sector of specialisation. The restructuring and moving towards a new business field was triggered by BOD Group's foreign partners (suppliers). The company's long-term partner in Germany, Singulus Technologies AG, partly shifted its business activities to the solar technologies sector in 2007. They subsequently invited BOD Group (currently Baltic Solar Energy) to join this growing new sector, and presented the future business prospects (Gaušas and Paliokaitė, 2011). Again, this must be a specific feature of a catching up economy, where greater value comes from the proximity of mature economies and their companies, than from the local science

base which is conservative and rather isolated from global technological and market trends. It has to be noted that this dissertation did not distinguish local suppliers from foreign ones in the measurement instrument due to the survey limitations (complex model, limited sample), however the role of foreign business partners could be an interesting research avenue for future studies.

Another interesting finding - the empirical research results showed that the relationship between *visioning* (applying methods such as road-mapping or balanced scorecard, having a systematic visioning process, plans and rigorous measurement of outcomes) and explorative innovation is stronger than a similar relationship to *analysing* (i.e. forecasting, modelling and building scenarios of alternative futures). Even more, the relationship of analysing to exploitative innovation was not statistically significant. Possibly, poor quality of analysis conducted at the Lithuanian manufacturing companies is one reason behind this. Managers were asked if they regularly analyse, forecast the future conditions, and if they regularly apply modelling and scenario methods. However, the quality of these methods was not examined. The quality of future analysis and specific methods used in Lithuanian industry could be further investigated with qualitative means, based for example on case studies.

The above-described empirical research results suggest that *these organisational foresight first-order capabilities are most important for pursuing explorative (radical) innovation*:

1. Regularly scanning the external environment in order to spot disruptive innovation opportunities or threats of disruption in mature markets, by using the 'strong tie sources' (e.g. suppliers, customers, trade shows) as well as 'weak tie sources' (e.g. one on one meetings and surveys of experts, researchers, scanning patent databases and scientific conferences);

2. Having strong visioning capabilities (routines), for example applying methods such as roadmapping or balanced scorecard, having a systematic visioning process, strategic and activity plans and rigorous measurement of outcomes.

3. Keeping a strong internal knowledge base by investing into R&D capacity, educated employees and continuous organisational learning, which will increase the chances of recognising the value of new information;

4. Having strong internal coordination capabilities, including the leadership capabilities that support organisational culture open to wider vision, focusing attention to encouraging employees to build internal and external networks, to discuss the basic

assumptions about the organisation's future and current activities, to bring external information into the company, and sharing the information freely across departments and functions.

5. Carefully analysing the acquired new information with the means of forecasting and modelling techniques, and building scenarios of the future, in order to identify the best novel opportunities for long-term growth, and also to prepare for the 'out of the box' disruptive situations, wild cards and 'black swans' that the company might face in the future.

First-order organisational foresight dimensions and exploitative innovation. Coordination capabilities have the strongest relationship to exploitative innovation of all the other eight first-order factors (beta = 0.582), followed by Visioning (0.506), which has a stronger relationship to exploitative innovation than it does to explorative innovation, and regularly scanning the Strong tie sources such as trade shows, suppliers and customers (0.274). Knowledge base and Depth of scanning had only weak to very weak relationship to exploitative innovation, and the contribution of Weak tie sources and Analysing was not statistically significant. The lack of role of analysing in this relationship to exploitative innovation does not support the theoretical proposition by Rohrbeck and Gemuenden (2011) that foresight acts as an opponent in evaluating existing products. Again, it can only be assumed that the reason behind it could be the poor quality of analysis conducted at the Lithuanian manufacturing companies. The quality of organisational foresight capabilities (e.g. analysing) could be further investigated with the means of qualitative research, such as case studies.

The research results suggest that *these organisational foresight first-order capabilities are most important for pursuing exploitative (incremental) innovation*:

1. Having strong internal coordination capabilities as described above;

2. Having strong visioning capabilities (routines), for example applying methods such as roadmapping or balanced scorecard, having a systematic visioning process, strategic and activity plans and rigorous measurement of outcomes.

3. Scanning regularly the external strong tie sources, such as suppliers, customers, regular business partners and trade shows;

4. Investing into a strong internal knowledge base.

Visioning, Depth of scanning and Time horizon are also related to explorative innovation, same as Depth has a statistically significant positive contribution to exploitative innovation. Having the full set of organisational foresight capabilities in one

organisation, according to the results of this study, would increase the possibility of becoming not only 'foresightful', but also an ambidextrous organisation – organisation that is able to manage its business in an efficient way, while at the same time being adaptable to the changes in its environment so that it is 'still around tomorrow' (Tushman and O'Reilly, 1996).

Moderating effects. Importantly, this study found that the organisation's *coordination capabilities as well as its knowledge base (integrating capabilities) are significant intermediary factors in taking advantage of environmental scanning*. Empirical research results confirmed that integrating capabilities acting as a moderator slightly improves the strength of the relationship between environmental scanning capabilities and exploitative or explorative innovation. It means that if a company does not invest in the educated and experienced labour force, product development activities such as R&D, continuous learning processes and internal coordination efforts, the value of information generated from external sources can be lost. The stronger the internal knowledge base and coordination, the higher the effect of implemented environmental scanning processes. These findings confirmed findings from previous studies on absorptive capacity defined by Cohen and Levinthal (1990) as the ability of an enterprise to recognize the value of new, external information, assimilate it, and apply it to commercial ends. Absorptive capacity was discussed as a promising explanation of innovation (Tsai, 2001), business performance (Lane, Salk and Lyles, 2001; Tsai, 2001), and inter-organisational learning (Lane and Lubatkin, 1998). It is enterprises with higher absorptive capacities are more likely to establish linkages and gain the most from the external sources of knowledge. Integrating capabilities are thus important enablers of foresight success. Specifically, propositions by scholars from both ambidexterity (e.g. Reisch et al., 2009; Gibson and Birkinshaw, 2004; Jansen, van den Bosch et al., 2005, Tushman and O'Reilly, 1996) and foresight research (e.g. Day and Schoemaker, 2005; Rohrbeck, 2010) who stress the role of leadership and coordination, were confirmed.

CONCLUSIONS AND MANAGERIAL IMPLICATIONS

This dissertation explored the relationship among organisational foresight and organisational ambidexterity in Lithuanian manufacturing companies' setting. It has been theoretically specified what defines organisational foresight and the relationship between organisational foresight and organisational ambidexterity has been empirically tested. This study yields several important findings and contributions to theory:

1. Firstly, this dissertation contributes to the theoretical conceptualisation of organisational foresight by describing it as a set of organisational capabilities. The organisational foresight concept emerged from the field of futures research, where most of contributions came from foresight practitioners with few attempts to explain organisational foresight by theoretical frames. This study contributed to the development of the organisational foresight construct by applying the theoretical frames of evolutionary economics (Nelson and Winter, 1982), dynamic capabilities (Teece, 1997, 2007) and organisational learning (March, 1991). These theoretical frames contributed to broadening the understanding of organisational foresight described as a capabilities model as opposed to 'episodic' foresight or a set of certain methods. The capability-based conceptualisation of organisational foresight challenges existing understanding of foresight as a methods-based, institutionalised, or 'one-off activity that is facilitated by experts with specific end points (Sarpong, 2010). From this perspective, the dissertation suggest that organisational foresight is an organisational practice that takes place at the micro-level organisational practices and routines. The proposed conceptual model allows to assess organisational foresight capabilities in all types of companies, whereas previous research has been limited to large multinational corporations. Establishing foresight as a capability means that some groundwork has been laid. It permits a more unified research approach, and thus the promotion of future progress in the discipline. Organisational foresight construct has been defined precisely enough to allow quantitative measures to be developed.

2. Second major contribution of this dissertation is one of the first attempts to develop a valid and reliable scale for measuring organisational foresight. The study specified what organisational capabilities define organisational foresight and proposed the conceptual model of organisational foresight consisting of three second-order dimensions (environmental scanning, strategic selection and integrating capabilities)

and eight first-order dimensions (usage of strong tie sources, usage of weak tie sources, time horizon, depth of scanning, analysing, visioning, coordination and knowledge base). By developing and testing the organisational foresight scale, this study contributes to further advancement of organisational foresight into a quantitatively measurable concept. Companies can be assessed and compared in terms of organisational foresight. The proposed conceptual model and organisational foresight scale are important steps for developing testable constructs and hypotheses and thus leading the transition to deductive research and theory testing. The results of the validation procedures employed in this dissertation provide the foundation for further improvement and validation of the measurement scales.

3. Importantly, this dissertation contributes to providing empirical evidence to the relationship between organisational foresight and organisational ambidexterity. The study confirms the importance of organisational foresight, recognising its contribution to both explorative and exploitative innovation. Although most research concerning the relation between organisational foresight and innovation has so far focused on radical (explorative innovation), the results of this study suggest that the positive relationships between organisational foresight and explorative innovation as well as exploitative innovation are quite similar. This serves as empirical basis for further research in this direction.

4. The empirical findings of this dissertation confirmed statistically significant positive relationships between all three groups of second-order capabilities (environmental scanning, strategic selection and integrating capabilities) and organisational ambidexterity. This dissertation proposed that, since exploitation and exploration are two distinct types of innovation, their relation to organisational capabilities is also different. Environmental scanning capabilities play a leading role when fostering explorative innovation, followed by integrating capabilities and strategic selection capabilities. However, environmental scanning's contribution to exploitative innovation is weakest if compared to other organisational foresight capabilities. It can be explained by the nature of environmental scanning delineated as search activities that scan the external environment in order to find either alternatives to existing routines or new routines. Further, in the relationship between foresight and exploitative innovation mainly integrating capabilities play a leading role, followed by strategic selection and environmental scanning.

5. Empirical findings of this dissertation confirmed the moderating effects of integrating capabilities. The organisation's coordination capabilities as well as its knowledge base (integrating capabilities) were found to be significant intermediary factors in taking advantage of environmental scanning. Research results suggest that that the higher the degree of integrating capabilities, the stronger the relationship between environmental scanning capabilities and exploitative or explorative innovation. Hence, integrating capabilities are paramount for exploiting and assimilating the value of new information generated from external sources.

6. Coordination capabilities (for example, encouraging employees to build internal and external networks, to discuss the basic assumptions about the organisation's future and current activities, to bring external information into the company, and sharing the information freely across departments and functions) had the strongest relationship to *exploitative innovation* of all the other eight first-order organisational foresight dimensions, followed by visioning (for example, applying methods such as roadmapping or balanced scorecard, having a systematic visioning process, plans and rigorous measurement of outcomes) and regularly scanning the strong tie sources (such as trade shows, suppliers and customers). The research results suggest that these organisational foresight first-order capabilities are most important for pursuing exploitative (incremental) innovation. Knowledge base and Depth of scanning had only weak to very weak relationship to exploitative innovation, and the contribution of Weak tie sources and Analysing was not statistically confirmed.

7. The research results also proposed that all the organisational foresight first-order factors had a statistically significant relationship to explorative innovation. According to the collected empirical evidence, these organisational foresight first-order capabilities contribute most to pursuing explorative (radical) innovation (in the descending order of priority): scanning the strong tie sources (e.g. customers, suppliers); having a strong internal knowledge base (R&D capacity, employees' education and continuous organisational learning); coordination activities (including the role of leadership); scanning the weak tie sources (e.g. experts, researchers, patent' databases); analysing (forecasting, modelling and scenario building). The results show that of all the environmental scanning dimensions scanning the exploitation of strong tie sources has strongest relationship to explorative innovation, in contrast to the Granovetters (1982) theory that weak ties in contrast to strong ties provide access to conceptually novel information.

The results of this study provide valuable practical suggestions and managerial implications:

1. Rohrbeck (2010) and Day and Schoemaker (2005) argued that technological turbulence in a firm's external environment serves as stimulus for higher degree of organisational foresight activities. This dissertation confirmed that firms facing higher than average technological turbulence have also stronger organisational foresight capabilities and greater innovation results. The Lithuanian manufacturing sector is currently faced with an increasing need for restructuring that requires foresight knowledge. This need stems from the long term global challenges as well as from existing structure of Lithuanian industry and the prevailing competitiveness strategy still dependent on low costs. This strategy is losing its competitive edge very fast due to increasing costs of key production factors, fast technological change and global competition, especially from 'new economies' (Paliokaitė and Martinaitis et al., 2013). The proposed contributions of this dissertation prove the importance of foresight (for e.g. achieving better innovation outcomes) for Lithuanian companies, and provides tools for assessing and developing organisational foresight capabilities.

2. The proposed organisational foresight scale can be used by other scholars and company managers in order to assess and compare companies in terms of organisational foresight. The measurement scales can be valuable managerial tools in practice. They can help diagnosing problems, weaknesses and strengths. Such instruments can be helpful in improving the current condition in organisational foresight capabilities.

3. The multidimensional model based on eight subcomponents of organisational foresight provides a comprehensive approach towards organisational foresight. It allows other researchers as well as practitioners looking for relationships between organisational foresight and other important factors and variables, such as innovation and firm performance.

4. The research study has provided empirical evidence to the positive relationship between organisational foresight and both exploitative and explorative innovation. Hence, companies can focus on cultivation of different organisational capabilities for ambidextrous innovation in the dynamic environment. By doing so they can use change to innovate and shape the future with novel technologies, products and services. The study findings provide practitioners with a viable way to build a

'foresightful' organisation by focusing on the eight conceptualised organisational foresight dimensions.

5. Research results suggest that those companies that are interested in better explorative (radical) innovation outcomes, need to invest into (i) regularly scanning the external environment by using the 'weak tie sources' (mainly the research community) as well as 'strong tie sources' (suppliers, customers and 'coopetitors') and ensuring focus on different time horizons and depth of scanning, (ii) visioning (with focus on visioning methods such as roadmapping or balanced scorecard, a systematic visioning process, strategic and activity plans and rigorous measurement of outcomes), (iii) solid internal knowledge base by investing into R&D capacity, educated employees and continuous organisational learning, which will increase the chances of recognising the value of new information, (iv) having strong internal coordination capabilities, including the leadership capabilities that support organisational culture open to wider vision, and (v) analysing the acquired new information with the means of forecasting and modelling techniques, and building scenarios of the future.

6. Organisations and managers need to pay attention to strategic selection and good coordination within organisation, as well as regularly keeping contacts with strong tie sources (suppliers, consumers and trade shows, possibly also other professional associations) in order to get better exploitative innovation results and improve business efficiency. Foresight can generate new innovation initiatives, but it also plays an important strategist role by creating and communicating vision, and an idea opponent / evaluator role that encourages to create better and more successful innovations by challenging basic assumptions, challenging the state-of-the-art of current R&D projects. Especially, the role of visioning has proven to be crucial for exploitative (incremental) innovations. Therefore, it is recommended to develop visioning capabilities (routines), by applying visioning methods such as roadmapping or balanced scorecard, having a systematic visioning process that involves everyone in the organisation and fosters long term strategic thinking, developing strategic and activity plans and applying rigorous measurement of outcomes to track how organisation's vision is implemented over time.

6. One of the key recommendations for practice stems from the confirmed moderating effects of integrating capabilities. The organisation's coordination capabilities as well as its knowledge base were found to be significant intermediary factors in taking advantage of environmental scanning. It means that if a company

does not invest in the educated and experienced labour force, product development activities such as R&D, continuous learning processes and internal coordination efforts, the value of information generated from external sources can be lost. The stronger the internal knowledge base and coordination, the higher the value of implemented environmental scanning processes.

SUGGESTIONS FOR FUTURE RESEARCH

This study provides the foundation for future research to further validate the organisational foresight construct and examine causal links with various firm performance variables in order to increase the understanding of the role of organisational foresight in organisations success. First, it is suggested that this research be tested on larger samples, which would allow further validation and refinement of the conceptual model and the measurement scales. For example, the limited research setting and sample did not allow to complete the validity procedures for the full three-level organisational foresight model with structural equation modelling means. Also, the validation procedures (CFA) were not finished for Depth and Time horizon scales. The scale of Knowledge base showed limited reliability and validity, hence future research could focus on the improvement and further validation of this scale.

Second, the causal links between organisational foresight and other variables of firm performance could be tested, because there have been few research studies with regard to the effects of organisational foresight practices on these variables. Third, the study could be replicated in different research settings, and comparisons between different sectors of economy and different countries, especially catching up economies and mature economies, could be explored. Fourth, longitudinal studies could be applied to put more focus on the antecedents and effects of organisational foresight or ambidextrous innovation, and to take into account the cycle of innovation development in the companies with long product development cycles. Finally, there is a need to test the research model using multiple methodologies, such as multivariate analysis of variance, case study and other qualitative research methodologies, to diagnose practices of both organisational foresight and organisational ambidexterity, and to explore, observe, explain or reconfirm findings from this empirical study.

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ANNEX 1. RESEARCH INSTRUMENT IN ENGLISH

Dear [Name, Surname],

We invite you to participate in a research project by completing a short survey. The main objective of this research is to determine the relationship between organisational foresight and innovation in manufacturing companies operating in Lithuania.

All responses are anonymous. The questionnaire should take you 15 minutes to complete. It is very important that you respond to each statement. Only then can we include your opinion in the final analysis.

QUESTIONNAIRE

1. Your current position in this company: _____

Please describe your organisation with the help of the following statements. All statements or questions in this survey were designed to determine the state of your enterprise or your perceptions about your enterprise. No answer is more correct than any other. There is no right or wrong.

NB: the questions in an actual survey were distributed in random order. They are not randomly distributed in this version of the questionnaire.

I. SCANNING

Sources **(from 1 – never to 7 - regularly)**

2. We participate in professional or industry association activities.
3. We attend scientific conferences.
4. Employees of my company work jointly with customers to develop solutions.
5. Employees of my company work jointly with suppliers in order to develop solution.
6. We collect information on patents.
7. We read specialized journals and magazines to keep abreast of market and technical trends
8. We conduct Internet and media research
9. We survey experts on their opinions, for example by using questionnaires, panels, focus groups, workshops, interviews, one to one meetings.

   Note: an expert is a person with extensive knowledge or ability based on research, experience, or occupation in a particular area of study, called in for advice on their respective subject.

Sources **(from 1 – strongly disagree to 7 – totally agree)**

10. We have an active network of contacts with the scientific community.
11. How much of the future conditions that you consider are less than 2 years in the future?
12. How much of the future conditions that you consider are from 2 to 5 years in the future?
13. How much of the future conditions that you consider are more than 5 years in the future?
14. How much of the future conditions that you consider are at least 15 years in the future?

15. We are scanning in all areas (technological, political, competitor, customer and socio-cultural environment).
16. We also scan for long-term developments in the markets and industries that we are not currently involved in.
17. We also consider new issues, trends and technologies whose relevance to our business cannot yet be assessed.

II. STRATEGIC SELECTION

(from 1 – never to 7 – regularly)

18. In our company, we analyze the potential future conditions.
19. We forecast the potential future conditions.
20. We use modelling for analysing future conditions (e.g. econometric modelling, simulation or systems models / systems analysis).
21. We use scenarios to describe and/or analyze potential futures.

(from 1 – strongly disagree to 7 – totally agree)

22. We have a systematic vision development process.
23. We apply visioning methods, for example balanced scorecard, appreciation inquiry, road-mapping.
24. Our company sets long term objectives that are consistent with its vision and values.
25. There is total agreement on our organisational vision across all levels, functions and divisions.
26. Our company develops activity plans that optimize progress toward the organisational strategy.
27. We explore a variety of potential options to achieve the long term objectives.
28. Our company applies rigorous measurement of business performance against goals and objectives.

III. CLIMATE

(from 1 – strongly disagree to 7 – totally agree)

29. Basic assumptions on the future of the company are explicit, much talked about and frequently challenged by the top management.
30. There are regular incentives (recognition by senior management and/or financial rewards) for wider vision.
31. Bringing external information into the company and maintaining an external network is encouraged by top management.
32. Every employee is expected to build and maintain formal and informal networks to other units.
33. In our company, information is shared freely across functions and hierarchical levels.
34. The activities of the different departments are well coordinated.
35. Our average annual R&D expenditures with respect to sales is one of highest in the industry.

36. Continued organisational learning is encouraged and there is time/opportunity to improve skills and capabilities.

(best estimate from 0% to 100%)

37. The percentage of our employees, who hold a Master's or Doctor's degree, is

38. The percentage of our employees having at least 5 years of work experience in our industry sector is

IV. INNOVATION

(from 1 – strongly disagree to 7 – totally agree)

39. We invent new products and services.

40. We commercialize products and services that are completely new to our company.

41. We frequently utilize new opportunities in new markets.

42. Our company regularly uses new distribution channels.

43. We regularly search for and approach new clients in new markets.

44. We frequently refine the precision of existing products and services.

45. We regularly implement small adaptations to existing products and services.

46. We introduce improved, but existing products and services for our local market.

47. We improve our provision's efficiency of products and services.

42. The technology affecting our industry is changing rapidly.

43. Technological changes provide big opportunities in our industry.

44. A large number of new product ideas have been made possible through technological breakthroughs in our industry.

V. BASIC INFORMATION ON THE ENTERPRISE

45. During the years 2005 to 2010, did your firm receive any external funds for research and/or innovation activities, for example: governmental loans or grants, bank loans, venture capital? **Y/ N**

ANNEX 2. REFINED RESEARCH INSTRUMENT IN LITHUANIAN

Gerbiamas [vardas, pavardė],

kviečiame dalyvauti moksliniame tyrime, kurio tikslas yra nustatyti ateities įžvalgos kompetencijas ir inovacijų būklę Lietuvos gamybos įmonėse.Jūsų dalyvavimas labai svarbus, nes buvote atrinktas kaip vienas tinkamiausių respondentų.

Visi atsakymai yra anonimiški. Atsakyti į klausimus truksite apie 15 minučių. Labai svarbu, kad atsakytumėte į visus klausimus. Tik tada Jūsų nuomonė bus įskaityta į galutinę analizę.

NB: the questions in an actual survey were distributed in random order. They are not randomly distributed in this version of the questionnaire.

KLAUSIMYNAS

1. Jūsų užimamos pareigos įmonėje: _____

Pastaba: tik vadovai, padalinių vadovai, žmonės, atsakingi už planavimą, gamybą ar pan. gali atsakyti į klausimus.

Apibūdinkite savo įmonę pagal toliau pateiktus teiginius. Išklausę kiekvieną teiginį ar klausimą, pateikite savo nuomonę ar geriausią apytikslį įvertinimą. Nėra teisingo ar klaidingo atsakymo.

I. APLINKOS TYRIMAS

Pateikite savo įvertinimą nuo 1 – niekada iki 7 – reguliariai.

2. Dalyvaujame profesinių asociacijų veikloje.
3. Dalyvaujame mokslinėse konferencijose.
4. Renkame informaciją apie patentuotus išradimus.
5. Mūsų darbuotojai dirba kartu su klientais ieškodami sprendimų.
6. Dalyvaujame prekybos parodose.
7. Skaitome specializuotus laikraščius ir žurnalus, norėdami neatsilikti nuo rinkos ir technologinių tendencijų.
8. Atliekame interneto ir žiniasklaidos tyrimus.
9. Ieškodami sprendimų darbuotojai bendradarbiauja su tiekėjais.

10. Atliekame ekspertų apklausas, teiraujamės jų nuomonės (*pavyzdžiui, pasitelkdami klausimynus, specialistų grupes, fokus grupes, seminarus, interviu, individualius susitikimus su ekspertais*).

Pastaba: ekspertai – tai specialistai, turintys gilias žinias tam tikroje rūpimoje srityje.

Pateikite savo įvertinimą nuo 1 – visiškai nesutinku iki 7 – visiškai sutinku.

11. Turime aktyvių kontaktų su mokslo bendruomene tinklą.

Atsakydami į toliau pateiktus klausimus, pateikite savo įvertinimą nuo 0 proc. iki 100 proc.

12. Kokia dalis jūsų svarstomų ateities sąlygų taps aktualūs per artimiausius dvejus metus?

13. Kokia dalis jūsų svarstomų ateities sąlygų pasireikš per laikotarpį tarp 2 ir 5 metų?

14. Kokia dalis jūsų svarstomų ateities sąlygų taps aktualūs daugiau nei po 5 metų?

15. Kokia dalis jūsų svarstomų ateities sąlygų taps aktualūs bent jau po 15 metų?

Pateikite savo įvertinimą nuo 1 – visiškai nesutinku iki 7 – visiškai sutinku.

16. Aplinką tiriame/stebime visose srityse (technologinėje, politinėje, konkurencinėje, klientų poreikių, socialinėje, kultūrinėje aplinkoje).

17. Tirdami aplinką, stebime tendencijas ir tose rinkose ar veiklos srityse, kuriose mūsų įmonė *šiuo metu nevysto veiklos*.

18. Tirdami aplinką, domimės ir tomis naujovėmis, tendencijomis, technologijomis, kurių aktualumą mūsų verslui kol kas sunku įvertinti.

II. STRATEGINĖ ATRANKA

Pateikite savo įvertinimą nuo 1 – niekada iki 7 – reguliariai.

19. Mūsų įmonė išsamiai analizuoja galimas verslo sąlygas ateityje.

20. Prognozuojame galimas verslo sąlygas ateityje.

21. Ateities sąlygų analizei pasitelkiame modeliavimą (*pavyzdžiui, ekonometrinį modeliavimą, simuliacijas, sistemų modelius, sistemų analizę ar kitus modelius*).

22. Norėdami apibūdinti galimą verslo ar įmonės ateitį, taikome scenarijus.

Pateikite savo įvertinimą nuo 1 – visiškai nesutinku iki 7 – visiškai sutinku.

23. Įmonėje taikome sisteminį ilgalaikės vizijos kūrimo procesą.

24. Taikome vizijų kūrimo metodus (*pavyzdžiui, kūrybines dirbtuves, subalansuotų veiklos matavimo rodiklių sistemą, išsamaus veiksmų plano metodą (angl. Roadmapping) ar kt.*).

Pastaba: subalansuotų veiklos matavimo rodiklių sistema (angliškai Balanced Scorecard) yra valdymo priemonė, kuri padeda planuoti ir vertinti, kaip organizacija progresuoja siekdama

strateginių tikslų. Ji susieja veiklos rodiklius su finansais, veiklos procesais, mokymosi poreikiais ir klientų poreikiais.

25. Esame apibrėžę įmonės viziją ir vertybes atitinkančius ilgalaikius tikslus.

26. Visuose lygmenyse, funkcijose ir padaliniuose yra sutarimas dėl ilgalaikės įmonės vizijos.

27. Įmonėje daug dėmesio skiriama planų kūrimui.

28. Įmonėje rengiami veiksmų planai, padedantys įgyvendinti įmonės strategiją.

29. Norėdami pasiekti ilgalaikių tikslų, nagrinėjame įvairias veiksmų galimybes.

30. Mūsų įmonėje remiamasi veiklos pasiekimų vertinimu pagal aiškiai apibrėžtus uždavinius.

III. KLIMATAS

Pateikite savo įvertinimą nuo 1 – visiškai nesutinku iki 7 – visiškai sutinku.

31. Svarbiausios įmonės ateities prielaidos yra aiškios, apie jas daug kalbama, jas kvestionuoja aukščiausia vadovybė.

32. Platesnis požiūris į įmonės ateities galimybes yra skatinamas (*pavyzdžiui, vadovybės pripažinimu ir (arba) finansinėmis paskatomis*).

33. Vadovybė teigiamai žiūri į naujos informacijos pritraukimą iš išorės aplinkos.

34. Skirtingų įmonės padalinių veikla yra gerai koordinuojama.

35. Tikimasi, kad kiekvienas darbuotojas kurs ir palaikys formalius ar neformalius ryšius su kitais padaliniais.

36. Mūsų įmonėje informacija laisvai keičiamasi tarp skirtingų funkcijų, pareigų ir atsakomybių lygmenų.

37. Mūsų įmonės vidutinės metinės išlaidos moksliniams tyrimams ir eksperimentinei plėtrai, lyginant su apyvarta, yra vienos didžiausių šioje pramonės šakoje.

38. Įmonėje skatinamas tęstinis mokymasis ir skiriama laiko / galimybių tobulinti darbuotojų įgūdžius ir gebėjimus.

Pateikite savo <u>tiksliausią galimą įvertinimą</u> nuo 0 proc. iki 100 proc.

39. Kiek procentų visų įmonės darbuotojų sudaro darbuotojai, turintys magistro ar daktaro diplomą?

40. Kiek procentų visų įmonės darbuotojų sudaro darbuotojai, turintys mažiausiai 5 metus darbo patirties jūsų įmonės verslo srityje?

IV. INOVACIJOS

Pateikite savo įvertinimą nuo 1 – visiškai nesutinku iki 7 – visiškai sutinku.

41. Mūsų verslui įtakos turinčios technologijos sparčiai kinta.

42. Technologijų pokyčiai mūsų verslo sektoriui suteikia daug galimybių.

43. Daugelį mūsų naujų produktų idėjų pavyko įgyvendinti technologinių atradimų dėka.

44. Kuriame naujus produktus ar paslaugas.

45. Rinkoje diegiame produktus ar paslaugas, kurie yra nauji mūsų įmonei.

46. Dažnai išnaudojame naujas galimybes naujose rinkose.

47. Įmonė dažnai pasirenka naujus paskirstymo kanalus.

48. Reguliariai ieškome naujų klientų naujose rinkose.

49. Dažnai tobuliname savo produktų ir paslaugų kokybę.

50. Reguliariai diegiame smulkius patobulinimus esamuose produktuose ar paslaugose.

51. Tobuliname savo produktų tiekimo ar paslaugų teikimo efektyvumą.

V. INFORMACIJA APIE ĮMONĘ

49. Ar per 2005–2010 m. laikotarpį Jūsų įmonė gavo papildomų lėšų (pavyzdžiui, vyriausybės paskolą ar dotaciją, banko paskolą, rizikos kapitalo investicijų) mokslinių tyrimų ar inovacijų veiklai? **Taip/ Ne**

ANNEX 3. MANN WHITNEY U TEST RESULTS

External financial aid for R&D and innovation (groups ‘yes’, ‘no’, NN = I don’t know)

		N	Mean	Std. Deviation	Std. Error	Mean Rank
Weaktie	Taip	67	3.8291	1.46701	.17922	137.57
	Ne	154	2.9188	1.27734	.10293	99.44
	NN	9	4.1056	1.63849	.54616	
	Total	230	3.2304	1.41578	.09335	130.97
Strongtie	Taip	67	6.0125	.97608	.11925	102.31
	Ne	154	5.4909	1.23826	.09978	
	NN	9	5.8104	1.08232	.36077	131.55
	Total	230	5.6554	1.18169	.07792	102.06
Timehorizon	Taip	67	4.8364	1.13240	.13834	
	Ne	154	4.3026	1.16362	.09377	118.22
	NN	9	4.6400	1.10843	.36948	107.86
	Total	230	4.4713	1.17320	.07736	
Depth	Taip	67	4.5841	1.14561	.13996	128.03
	Ne	154	4.4037	1.24237	.10011	103.59
	NN	9	4.9019	.67641	.22547	
	Total	230	4.4757	1.19980	.07911	123.80
Analysing	Taip	67	4.9855	1.23798	.15124	105.43
	Ne	154	4.4924	1.23713	.09969	
	NN	9	5.1814	.83583	.27861	115.18
	Total	230	4.6630	1.24469	.08207	109.18
Visioning	Taip	67	5.2011	1.17116	.14308	
	Ne	154	4.8773	1.15173	.09281	131.01
	NN	9	5.4344	1.34915	.44972	102.29
	Total	230	4.9934	1.17238	.07730	
Coordination	Taip	67	5.6209	.85148	.10402	136.00
	Ne	154	5.4701	1.08767	.08765	100.12
	NN	9	5.7333	.86023	.28674	
	Total	230	5.5243	1.01569	.06697	125.24
Knowledge base	Taip	67	3.3831	.98687	.12057	104.81
	Ne	154	2.9416	.88818	.07157	
	NN	9	3.5185	.66898	.22299	132.66
	Total	230	3.0928	.93303	.06152	101.57
Explorative	Taip	67	5.3953	1.02908	.12572	
	Ne	154	4.7079	1.21918	.09824	
	NN	9	5.4469	.91885	.30628	
	Total	230	4.9371	1.19782	.07898	
Exploitative	Taip	67	6.0239	.84109	.10276	
	Ne	154	5.6537	1.11443	.08980	
	NN	9	6.0815	.79147	.26382	
	Total	230	5.7783	1.04271	.06875	
FORESIGHT	Taip	67	4.8036	.80366	.09818	
	Ne	154	4.3899	.76060	.06129	
	NN	9	4.9328	.77929	.25976	
	Total	230	4.5317	.79709	.05256	

	Weak tie sources	Strong tie sources	Time horizon	Depth	Analysing	Visioning	Coordination	Knowledge base	Explorative innovation	Exploitative innovation	FORESIGHT
Mann-Whitney U	3378.5	3821.0	3782.0	4675.5	4018.0	4301.5	4879.0	3818.0	3484.0	4205.0	3707.5
Wilcoxon W	15313.5	15756.0	15717.0	16610.5	15953.0	16236.5	16814.0	15753.0	15419.0	16140.0	15642.5
Z	-4.082	-3.083	-3.162	-1.110	-2.616	-1.965	-.642	-3.096	-3.840	-2.203	-3.323
Exact Sig. (1-tailed)	**.000**	**.002**	**.002**	.267	**.009**	**.049**	.521	**.002**	**.000**	**.028**	**.001**

Company size (groups ‘Larger’, ‘Smaller’)

		N	Mean	Std. Deviation	Std. Error	Mean Rank
Weaktie	Smaller	166	3.1199	1.41254	.10963	109.98
	Larger	64	3.5172	1.39444	.17430	129.81
	Total	230	3.2304	1.41578	.09335	
Strongtie	Smaller	166	5.6055	1.17022	.09083	111.59
	Larger	64	5.7846	1.21065	.15133	125.63
	Total	230	5.6554	1.18169	.07792	
Timehorizon	Smaller	166	4.4746	1.18864	.09226	115.56
	Larger	64	4.4627	1.14133	.14267	115.35
	Total	230	4.4713	1.17320	.07736	
Depth	Smaller	166	4.4743	1.26911	.09850	115.86
	Larger	64	4.4794	1.00709	.12589	114.57
	Total	230	4.4757	1.19980	.07911	
Analysing	Smaller	166	4.6813	1.24865	.09691	115.86
	Larger	64	4.6156	1.24290	.15536	114.55
	Total	230	4.6630	1.24469	.08207	
Visioning	Smaller	166	4.9584	1.20584	.09359	113.43
	Larger	64	5.0843	1.08455	.13557	120.88
	Total	230	4.9934	1.17238	.07730	
Coordination	Smaller	166	5.4723	1.06950	.08301	113.00
	Larger	64	5.6594	.85351	.10669	121.98
	Total	230	5.5243	1.01569	.06697	
Knowledge base	Smaller	166	2.9920	.95555	.07416	107.27
	Larger	64	3.3542	.82268	.10284	136.86
	Total	230	3.0928	.93303	.06152	
Explorative	Smaller	166	4.8980	1.24951	.09698	114.08
	Larger	64	5.0385	1.05439	.13180	119.20
	Total	230	4.9371	1.19782	.07898	
Exploitative	Smaller	166	5.7478	1.10422	.08570	114.35
	Larger	64	5.8573	.86596	.10825	118.48
	Total	230	5.7783	1.04271	.06875	
FORESIGHT	Smaller	166	4.4902	.80392	.06240	112.36
	Larger	64	4.6392	.77495	.09687	123.64
	Total	230	4.5317	.79709	.05256	

	Weak tie sources	Strong tie sources	Time horizon	Depth	Analysing	Visioning	Coordination	Knowledge base	Explorative innovation	Exploitative innovation	FORESIGHT
Mann-Whitney U	4396.0	4663.5	5302.5	5252.5	5251.5	4968.0	4897.0	3945.0	5075.5	5121.5	4791.0
Wilcoxon W	18257.0	18524.5	7382.5	7332.5	7331.5	18829.0	18758.0	17806.0	18936.5	18982.5	18652.0
Z	-2.029	-1.444	-.021	-.132	-.134	-.761	-.920	-3.048	-.524	-.425	-1.152
Exact Sig. (1-tailed)	**.021**	.075	.492	.448	.447	.224	.179	**.001**	.301	.336	.125

Industry type (groups ‘A = high and medium high technology’, ‘B = low and medium low technology’)

		N	Mean	Std. Deviation	Std. Error	Mean Rank
Weaktie	A	32	4.0359	1.53902	.27206	148.84
	B	198	3.1003	1.35457	.09627	110.11
	Total	230	3.2304	1.41578	.09335	
Strongtie	A	32	5.9142	1.13653	.20091	132.98
	B	198	5.6135	1.18630	.08431	112.67
	Total	230	5.6554	1.18169	.07792	
Timehorizon	A	32	4.5058	1.22341	.21627	118.39
	B	198	4.4657	1.16800	.08301	115.03
	Total	230	4.4713	1.17320	.07736	
Depth	A	32	4.5906	.83640	.14786	118.08
	B	198	4.4572	1.24931	.08878	115.08
	Total	230	4.4757	1.19980	.07911	
Analysing	A	32	4.6489	1.22080	.21581	117.16
	B	198	4.6653	1.25154	.08894	115.23
	Total	230	4.6630	1.24469	.08207	
Visioning	A	32	5.3590	1.10486	.19531	135.08
	B	198	4.9343	1.17492	.08350	112.34
	Total	230	4.9934	1.17238	.07730	
Coordination	A	32	5.7313	.82166	.14525	126.23
	B	198	5.4909	1.04158	.07402	113.77
	Total	230	5.5243	1.01569	.06697	
Knowledge base	A	32	3.8333	.94660	.16734	164.97
	B	198	2.9731	.87605	.06226	107.51
	Total	230	3.0928	.93303	.06152	
Explorative	A	32	5.0139	1.22839	.21715	119.16
	B	198	4.9247	1.19553	.08496	114.91
	Total	230	4.9371	1.19782	.07898	
Exploitative	A	32	6.0250	.81891	.14476	128.34
	B	198	5.7384	1.07091	.07611	113.42
	Total	230	5.7783	1.04271	.06875	
FORESIGHT	A	32	4.8493	.75066	.13270	139.36
	B	198	4.4803	.79427	.05645	111.64
	Total	230	4.5317	.79709	.05256	

	Weak tie sources	Strong tie sources	Time horizon	Depth	Analysing	Visioning	Coordination	Knowledge base	Explorative innovation	Exploitative innovation	FORESIGHT
Mann-Whitney U	2101.0	2608.5	3075.5	3085.5	3115.0	2541.5	2824.5	1585.0	3051.0	2757.0	2404.5
Wilcoxon W	21802.0	22309.5	22776.5	22786.5	22816.0	22242.5	22525.5	21286.0	22752.0	22458.0	22105.5
Z	-3.060	-1.613	-.266	-.237	-.152	-1.796	-.986	-4.571	-.336	-1.188	-2.186
Exact Sig. (1-tailed)	**.001**	.053	.396	.407	.440	**.036**	.163	**.000**	.369	.118	**.014**

Turbulence (groups ‘High’ and ‘Low’)

		N	Mean	Std. Deviation	Std. Error	Mean Rank
Weaktie	Low	113	2.7876	1.11354	.10475	96.11
	High	117	3.6581	1.54411	.14275	134.23
	Total	230	3.2304	1.41578	.09335	
Strongtie	Low	113	5.3487	1.28691	.12106	97.27
	High	117	5.9516	.98870	.09140	133.11
	Total	230	5.6554	1.18169	.07792	
Timehorizon	Low	113	4.2720	1.19786	.11269	105.17
	High	117	4.6638	1.12060	.10360	125.47
	Total	230	4.4713	1.17320	.07736	
Depth	Low	113	4.2515	1.20433	.11329	103.66
	High	117	4.6923	1.15979	.10722	126.93
	Total	230	4.4757	1.19980	.07911	
Analysing	Low	113	4.3517	1.18384	.11137	98.57
	High	117	4.9637	1.23275	.11397	131.85
	Total	230	4.6630	1.24469	.08207	
Visioning	Low	113	4.5706	1.07733	.10135	90.81
	High	117	5.4017	1.11828	.10339	139.35
	Total	230	4.9934	1.17238	.07730	
Coordination	Low	113	5.2513	1.09602	.10311	96.87
	High	117	5.7880	.85673	.07921	133.50
	Total	230	5.5243	1.01569	.06697	
Knowledgebase	Low	113	2.7493	.72310	.06802	90.52
	High	117	3.4245	.99387	.09188	139.62
	Total	230	3.0928	.93303	.06152	
Explorative	Low	113	4.2967	1.11846	.10522	77.03
	High	117	5.5556	.91618	.08470	152.66
	Total	230	4.9371	1.19782	.07898	
Exploitative	Low	113	5.3274	1.11072	.10449	86.97
	High	117	6.2137	.75234	.06955	143.06
	Total	230	5.7783	1.04271	.06875	
FORESIGHT	Low	113	4.2088	.73199	.06886	89.04
	High	117	4.8435	.73304	.06777	141.06
	Total	230	4.5317	.79709	.05256	

	Weak tie sources	Strong tie sources	Time horizon	Depth	Analysing	Visioning	Coordination	Knowledge base	Explorative innovation	Exploitative innovation	FORESIGHT
Mann-Whitney U	4419.0	4550.0	5443.5	5273.0	4697.5	3820.0	4505.0	3788.0	2263.0	3386.5	3620.0
Wilcoxon W	10860.0	10991.0	11884.5	11714.0	11138.5	10261.0	10946.0	10229.0	8704.00	9827.50	10061.0
Z	-4.350	-4.112	-2.321	-2.660	-3.798	-5.537	-4.184	-5.642	-8.632	-6.450	-5.929
Exact Sig. (1-tailed)	**.000**	**.000**	**.020**	**.008**	**.000**	**.000**	**.000**	**.000**	**.000**	**.000**	**.000**

ANNEX 4. ANALYSIS OF MODERATING EFFECTS

Model fit test results: regression analysis on strategic selection as a moderator, dependent variable – exploitative innovation

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate
1	.568[a]	.323	.317	.86191
2	.597[b]	.357	.348	.84176

a. Predictors: (Constant), SELECTION, SCANNING
b. Predictors: (Constant), SELECTION, SCANNING, moderator_select

Regression coefficients, dependent variable – exploitative innovation

Model		Unstandardized Coefficients		Standardized Coefficients	t	Sig.
		B	Std. Error	Beta		
1	(Constant)	2.709	.322		8.419	.000
	SELECTION	.408	.061	.434	6.668	.000
	SCANNING	.247	.080	**.200**	3.075	.002
2	(Constant)	2.914	.320		9.112	.000
	SELECTION	.388	.060	.412	6.453	.000
	SCANNING	.245	.078	**.199**	3.125	.002
	moderator_select	-.180	.052	-.186	-3.464	.001

Model fit test results: regression analysis on strategic selection as a moderator, dependent variable – explorative innovation

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate
1	.667[a]	.444	.439	.89688
2	.682[b]	.465	.458	.88186

a. Predictors: (Constant), SCANNING, SELECTION
b. Predictors: (Constant), SCANNING, SELECTION, moderator_select

Regression coefficients, strategic selection as a moderator, dependent variable – explorative innovation

Model		Unstandardized Coefficients		Standardized Coefficients	t	Sig.
		B	Std. Error	Beta		
1	(Constant)	.517	.335		1.544	.124
	SCANNING	.777	.083	**.549**	9.315	.000
	SELECTION	.198	.064	.183	3.106	.002
2	(Constant)	.701	.335		2.092	.038
	SCANNING	.776	.082	**.548**	9.453	.000
	SELECTION	.179	.063	.166	2.850	.005
	moderator_select	-.161	.054	-.145	-2.966	.003

Model fit test results: regression analysis on integrating capabilities as a moderator, dependent variable – explorative innovation

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate
1	.679[a]	.461	.456	.88365
2	.692[b]	.478	.471	.87084

a. Predictors: (Constant), SCANNING, INTEGRATING
b. Predictors: (Constant), SCANNING, INTEGRATING, moderator_integra

Regression coefficients, integrating capabilities as a moderator, dependent variable – explorative innovation

Model		Unstandardized Coefficients		Standardized Coefficients	t	Sig.
		B	Std. Error	Beta		
1	(Constant)	.201	.350		.573	.567
	SCANNING	.747	.081	**.528**	9.264	.000
	INTEGRATING	.326	.080	.233	4.097	.000
2	(Constant)	.348	.349		.996	.320
	SCANNING	.769	.080	**.543**	9.626	.000
	INTEGRATING	.286	.080	.204	3.577	.000
	moderator_integra	-.132	.048	-.136	-2.779	.006

Model fit test results: regression analysis on integrating capabilities as a moderator, dependent variable – exploitative innovation

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate
1	.682[a]	.465	.460	.76631
2	.708[b]	.501	.494	.74168

a. Predictors: (Constant), INTEGRATING, SCANNING
b. Predictors: (Constant), INTEGRATING, SCANNING, moderator_integra

Regression coefficients, integrating capabilities as a moderator, dependent variable – explorative innovation

Model		Unstandardized Coefficients		Standardized Coefficients	t	Sig.
		B	Std. Error	Beta		
1	(Constant)	1.914	.304		6.302	.000
	INTEGRATING	.745	.069	.612	10.790	.000
	SCANNING	.147	.070	**.119**	2.097	.037
2	(Constant)	2.096	.297		7.048	.000
	INTEGRATING	.695	.068	.571	10.218	.000
	SCANNING	.173	.068	**.141**	2.550	.011
	moderator_integra	-.164	.041	-.193	-4.041	.000

Model fit test results: regression analysis on integrating capabilities as a moderator in the strategic selection – exploitative innovation relationship

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate
1	.685[a]	.470	.465	.76259
2	.701[b]	.492	.485	.74833

b. Predictors: (Constant), INTEGRATING, SELECTION
c. Predictors: (Constant), INTEGRATING, SELECTION, moderator_integra_s

Regression coefficients, integrating capabilities as a moderator in the strategic selection – exploitative innovation relationship

Model		Unstandardized Coefficients		Standardized Coefficients	t	Sig.
		B	Std. Error	Beta		
1	(Constant)	2.071	.267		7.755	.000
	INTEGRATING	.684	.079	**.562**	8.664	.000
	SELECTION	.158	.061	.168	2.582	.010
2	(Constant)	2.405	.283		8.496	.000
	INTEGRATING	.630	.079	**.518**	7.944	.000
	SELECTION	.155	.060	.165	2.584	.010
	moderator_integra_s	-.136	.044	-.155	-3.119	.002

Model fit test results: regression analysis on integrating capabilities as a moderator in the strategic selection – explorative innovation relationship

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate
1	.542[a]	.294	.287	1.01111
2	.542[b]	.294	.284	1.01328

a. Predictors: (Constant), INTEGRATING, SELECTION
b. Predictors: (Constant), INTEGRATING, SELECTION, moderator_integra_s

Regression coefficients, integrating capabilities as a moderator in the strategic selection – explorative innovation relationship

Model		Unstandardized Coefficients		Standardized Coefficients	t	Sig.
		B	Std. Error	Beta		
1	(Constant)	1.577	.354		4.455	.000
	SELECTION	.279	.081	.259	3.454	.001
	INTEGRATING	.467	.105	.334	4.458	.000
2	(Constant)	1.552	.383		4.048	.000
	SELECTION	.280	.081	.259	3.448	.001
	INTEGRATING	.471	.107	.337	4.381	.000
	moderator_integra_s	.010	.059	.010	.175	.862