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Paulius ŠŪMAKARIS

ECO-INNOVATION STRATEGIES IN THE DEVELOPMENT OF INTERNATIONALIZATION

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Abstract

The dissertation investigates the problematic and theoretical aspects of eco-innovation strategies in the context of internationalization with a particular focus on the entrance of furniture manufacturing companies to new foreign markets and the preparation for the internationalization phase. The dissertation aims to substantiate the decision-support framework for rational selection of eco-innovation strategy in the context of internationalization.

The dissertation consists of an introduction, three chapters, general conclusions, a list of references, a list of the author's publications, a summary in Lithuanian, and six annexes. The First Chapter presents the conceptualization of the four main pillars of this dissertation: eco-innovation, eco-innovation strategy, internationalization, and strategic decision-making. The chapter concludes by formulating the theoretical framework for the selection of an eco-innovation strategy in the pre-internationalization phase and a hierarchical structure of the decision problem, which serves as a starting point for empirical research. The empirical study was conducted within the Lithuanian furniture industry (NACE C31). This dissertation adopted an exploratory multiple case study approach with a positivistic philosophical paradigm as a research strategy and a mixed inquiry technique was applied, which is presented in the Second Chapter. Based on a theoretical framework and a hierarchical structure of the decision problem, the empirical research methodology with data collection tools was developed and tested through a pilot study with industry experts. For the development and empirical justification of the decision support framework, a mixed decision-making process, and a combination of MCDM methods were adopted, which include the Delphi technique, AHP, BWM, TOPSIS, and sensitivity analysis. Additionally, qualitative research was conducted to gain in-depth insight into the phenomenon under investigation. The proposed decision-support framework for the rational selection of the eco-innovation strategy in the pre-internationalization phase was applied in three real-world cases. The empirical research results of the pilot study, the practical application of the decision-support framework in multiple cases, and the qualitative research findings are presented in the Third Chapter, which is concluded with a discussion of theoretical and practical implications, limitations, and agenda for future research.

The results of the dissertation have been disseminated in three articles in peer-reviewed international scientific journals that are indexed in the *Clarivate Analytics Web of Science* and *Scopus* databases and two papers in the international conference proceedings. The results were presented at four international scientific conferences in Lithuania and abroad.

Reziumė

Disertacijoje nagrinėjami probleminiai ir teoriniai ekoinovacijų strategijų aspektai internacionalizacijos kontekste, ypatingą dėmesį skiriant gamybos įmonių patekimui į naujas užsienio rinkas bei pasiruošimo internacionalizacijai etapui. Darbo tikslas – pagrįsti sprendimų priėmimo paramos modelį, taikomą racionaliam ekoinovacijų strategijos parinkimui internacionalizacijos kontekste.

Disertaciją sudaro įvadas, trys dalys, bendrosios išvados, literatūros sąrašas, autoriaus publikacijų disertacijos tema sąrašas ir šeši priedai. Pirmame skyriuje pateikiamos pagrindinės šios disertacijos koncepcijos, kurios apima ekoinovacijas, ekoinovacijų strategijas, internacionalizaciją ir strateginių sprendimų priėmimo procesą. Skyriaus pabaigoje pateikiama teorinė ekoinovacijų strategijos parinkimo įmonės pasiruošimo internacionalizacijai etape priemonė ir sprendimo priėmimo problemos, kylančios parenkant ekoinovacijų strategiją, hierarchinė struktūra, kuri yra empirinių tyrimų atspirties taškas. Empiriniai tyrimai buvo atlikti Lietuvos baldų pramonėje (NACE C31). Šioje disertacijoje taikytas kelių atvejų analizės tyrimas, grįstas pozityvistine filosofine paradigma, ir kokybinių bei kiekybinių metodų derinys, kaip empirinių tyrimų strategija, kuri pateikta antrame skyriuje. Remiantis pirmame skyriuje suformuota teorine priemone ir sprendimo problemos hierarchine struktūra, buvo parengta empirinė tyrimų metodika su duomenų rinkimo instrumentais ir išbandyta atliekant bandomąjį tyrimą kartu su pramonės ekspertais. Sprendimų priėmimo paramos modeliui kurti ir empiriškai patvirtinti buvo taikytas mišrus sprendimų priėmimo procesas ir daugiakriterių vertinimo metodų derinys, apimantis *Delfi*, AHP, BWM, TOPSIS ir jautrumo analizę. Papildomai, siekiant geriau suprasti tiriamą reiškinį, buvo atlikti kokybiniai tyrimai. Siūlomas sprendimų priėmimo paramos modelis, skirtas racionaliam ekoinovacijų strategijos pasirinkimui pasiruošimo internacionalizacijai etape, buvo pritaikytas trijose Lietuvos baldų pramonės vidutinio dydžio įmonėse. Bandomojo tyrimo empiriniai rezultatai, praktinio sprendimų priėmimo paramos modelio taikymo rezultatai ir kokybinio tyrimo rezultatai pateikiami trečiame skyriuje. Skyrius baigiamas diskusija, teorine ir praktine darbo reikšme, ribotumų nurodymu ir tolesnių tyrimų gairėmis.

Disertacijos tema paskelbti šie moksliniai straipsniai: trys straipsniai recenzuojamuose tarptautiniuose mokslo žurnaluose, kurie yra indeksuojami *Clarivate Analytics Web of Science* ir *Scopus* duomenų bazėse, du tarptautinių konferencijų straipsniai. Disertacijoje atliktų tyrimų rezultatai pristatyti keturiose mokslinėse konferencijose Lietuvoje ir užsienyje.

Notations

Abbreviations

AHP – analytic hierarchy process (liet. *Analitinis hierarchijos procesas*);
BWM – best-worst method (liet. *Geriausias blogiausias metodas*);
CIS – community innovation survey (liet. *Bendrijos inovacijų tyrimai*);
DM – decision-maker (liet. *Sprendimus priimantis asmuo*);
EU – European Union (liet. *Europos Sąjunga*);
IR – internationalization readiness (liet. *Pasirengimas internacionalizacijai);*
MCDM – multi-criteria decision-making method (liet. *daugiakriterinio vertinimo metodas*);
NRBV – natural resource-based view (liet. *Natūraliais ištekliais grįstas požiūris*);
OAT – one at a time method (liet. *vienas kintamasis vienu metu*);
OECD – Organization for Economic Cooperation and Development (liet. *Ekonominio bendradarbiavimo ir plėtros organizacija*);
R&D – research and development (liet. *moksliniai tyrimai ir eksperimentinė plėtra*);
RBV – resource-based view (liet. *Ištekliais grįstas požiūris*);
SME – small and medium-sized enterprise (liet. *smulkus ir vidutinis verslas*);
TOPSIS – a technique for order preference by similarity to ideal solution (liet. *Artumo idealiam taškui metodas*).

Contents

Introduction

Problem Formulation

Empirical studies recognize the importance of internationalization and eco-innovation for the performance of business companies. However, to date, very little is known about the interrelationships between the two (Galbreath et al., 2021; Martínez-Ros & Merino, 2023). Furthermore, despite the growing scientific discussions on eco-innovation, there is a noticeable research gap when it comes to a comprehensive understanding of the concept of an eco-innovation strategy (Shukla, 2019; López Pérez et al., 2023). Current conceptualizations of eco-innovation strategy are notably constrained. They frequently overlap with an organization's environmental strategy and fall short of encompassing the full scope of the strategic approach to eco-innovation (Luan et al., 2023; Sun & Sun, 2021).

Most studies investigate eco-innovation from the perspective of a solitary solution and isolated practices, and there is a shortage of studies on the phenomenon from an organizational management and strategic decision-making perspective (López Pérez et al., 2023; Tamayo-Orbegozo et al., 2017). Approaching eco-innovation from a non-strategic perspective may result in long-term negative consequences, such as ineffective resource expenditure on isolated eco-innovation practices that are widely spread throughout the firm, losing valuable resources,

customers, and competitiveness (Wijethilake et al., 2018). However, strategic decision-making related to eco-innovation is a complex process. Companies are more likely to prioritize strategic eco-innovation investments once they are aware that eco-innovation will improve their performance (Chappin et al., 2020).

Therefore, the problem lies in the trade-off between economic and environmental performance when companies face a challenging strategic decision and are forced to equilibrate both economic and environmental dimensions. However, the concept of eco-innovation strategies in the development of internationalization is a relatively new phenomenon, and empirical research examining the strategic decision-making related to eco-innovation in the pre-internationalization phase has so far been neglected in the scientific literature. Consequently, the complexities, novel aspects, and limited knowledge make it challenging to establish a robust eco-innovation strategy as a pivotal component of the internationalization strategy.

Relevance of the Dissertation

In recent years, global concern has escalated toward the repercussions of economic development on the environment (Zhang et al., 2022). In response to environmental challenges, many OECD countries have acknowledged the significance of eco-innovation (Ullah et al., 2022). With major investment programs such as the European Green Deal and Horizon Europe, the EU actively promotes innovative eco-friendly practices (EIO, 2019). Furthermore, recent geopolitical, economic, and socio-environmental crises have accelerated the ongoing shift toward green industrial transformation (ETTG, 2022), which is a contextualized, multifaceted technological and socioeconomic process that is closely related to eco-innovation (Inovacijų agentūra, 2023).

In addition to worldwide environmental regulations and the pursuit of sustainable development, both rapid globalization and growing consumer demand for eco-friendly products and processes increasingly drive business companies to adopt eco-friendly strategies (Qing et al., 2022). Such governmental push and market pull factors have opened new horizons for establishing new competitive rules in business practice (Huang & Li, 2018; Zameer et al., 2022).

Hence, environmental policies and incentives typically arise at the macro level, market demand is associated with the meso level, whereas the realization of eco-innovation is observed at the micro level (Allacker et al., 2019). Therefore, changes must occur at the business company level to achieve systemic industrial green transformation. However, business companies first need to understand the benefits of eco-innovation and have eligible measures to address the trade-offs between economic and environmental development and achieve green transformation without jeopardizing the company's performance.

Research Object

The object of the research is eco-innovation strategies in the context of internationalization.

Aim of the Dissertation

The dissertation aims to substantiate the decision-support framework for rational selection of eco-innovation strategy in the context of internationalization.

Tasks of the Dissertation

1. To conceptualize eco-innovation, types of eco-innovation, eco-innovation adoption, and eco-innovation strategies of companies by identifying the main characteristics from the perspectives of strategic green transformation and competitive advantage in international markets.
2. To substantiate the application of a strategic decision-making perspective for selecting an eco-innovation strategy in the pre-internationalization phase by identifying strategic business capabilities, resources, and external environment factors.
3. To ground the theoretical framework for selecting an eco-innovation strategy in the pre-internationalization phase by integrating suggested eco-innovation strategy alternatives and eco-innovation strategy selection impacting factors.
4. To define the philosophical and methodological approach to explore the cases of selection of eco-innovation strategy in the pre-internationalization phase.
5. To empirically justify the proposed decision-support framework for rational selection of eco-innovation strategy in the pre-internationalization phase and to gain an understanding of the strategic decision-making process and its outcomes.

Research Methodology

This dissertation has adopted an exploratory multiple case study approach with a positivistic philosophical paradigm and a mixed inquiry technique as a research strategy. The First Chapter is dedicated to the theoretical framework for eco-innovation strategies in the development of internationalization. Various research

methods, such as logical, systematic, and comparative analysis, were used. The Second Chapter is dedicated to the methodology for rational selection of eco-innovation strategy in the pre-internationalization phase. First, the empirical research methodology with data collection tools was developed and tested through a pilot study with Lithuanian furniture industry experts. Subsequently, to develop and empirically confirm the decision-support framework, a combination of MCDM methods was adopted, which include the Delphi technique, AHP, BWM, TOPSIS methods and sensitivity analysis. The proposed decision-support framework was applied in three medium-sized Lithuanian furniture industry manufacturing companies, which are in the pre-internationalization phase. Qualitative research was conducted simultaneously, and empirical data was collected through a questionnaire, used in semi-structured interviews, followed by a qualitative content analysis. The Third Chapter presents the analysis of the empirical research findings.

Scientific Novelty of the Dissertation

In the course of developing the dissertation, the following significant results for management science have been achieved:

1. The innovation management body of knowledge has been complemented by a novel concept of eco-innovation strategy, which shifts the focus from the traditional selection of solitary eco-innovation solutions to a set of eco-innovations and specifically targets the strategic green transformation of products or processes so that the outcome is a systemic change at the company level.
2. The strategic management body of knowledge has been complemented by a novel approach of strategic decision-making perspective for the selection of eco-innovation strategy in the pre-internationalization phase by identifying strategic business capabilities, resources, and external environment factors, and a classification of eco-innovation strategy alternatives based on the competitive orientation of the company to address the trade-off between economic and environmental dimensions.
3. Internationalization body of knowledge has been complemented by a comprehensive understanding of the relationships of eco-innovation and internationalization, integrating the selection of eco-innovation strategy in the pre-internationalization phase and shedding light on the emerging field of "green internationalization", as well as challenging the traditional scientific approaches to international development, which mainly neglects the critical phase of pre-internationalization.
4. The methodological novelty lies in the applied exploratory multiple case study with a positivistic philosophical paradigm and an original

combination of qualitative and quantitative methods as an empirical research strategy.
5. The empirically justified decision-support framework integrates the fundamental theories and models of strategic management, innovation management, and internationalization and provides a systematic approach to assessing the micro-, meso-, and macro-level decision-impacting factors in the strategic decision-making process related to the rational selection of eco-innovation strategy in the pre-internationalization phase of the furniture manufacturing company.

Practical Value of the Research Findings

1. The proposed decision-support framework is designed to aid decision-makers in selecting the best eco-innovation strategy to implement the firm's strategic green transformation of products or processes in new international markets.
2. The proposed decision-support framework is intended for every furniture manufacturing firm that faces challenges, such as the selection of a competitive eco-innovation strategy for new international market entry, adaptation to rapidly changing global environmental pressures and requirements, efficient usage of limited resources, and the need to focus on a specific area of strategic green transformation.
3. The results of this dissertation are useful for decision-makers, policy-makers, and governmental bodies responsible for eco-innovation and internationalization policies and support measures. This way, the research contributes to the "European Green Deal" strategy for Europe to become the world's first climate-neutral continent by 2050.

Defended Statements

1. In the context of contemporary business practice, the increase of competitive advantage in international markets and the transition to climate-neutral production requires a systematic and holistic approach in which the trade-off between economic and environmental dimensions is addressed rather than the implementation of solitary eco-innovation solutions. Thus, this issue is addressed by the proposed novel concept of eco-innovation strategy and a classification of eco-innovation strategy types.

2. International development of contemporary furniture manufacturing companies requires that the eco-innovation strategy be considered an integral strategy of the company's internationalization strategy, and the issue of interrelationships of internationalization and eco-innovation is addressed by the proposed framework integrating strategic decisions related to the selection of eco-innovation strategy within the stream of strategic decisions in the pre-internationalization phase.
3. The empirically justified methodology for a systematic assessment of micro-, meso-, and macro-level decision-impacting factors can be used in the strategic decision-making process for rational selection of eco-innovation strategy in the pre-internationalization phase of the furniture manufacturing firm.

Approval of the Research Findings

The following scientific papers were published on the topic of the dissertation: three articles in peer-reviewed international scientific journals that are indexed in the *Clarivate Analytics Web of Science* and *Scopus* databases (Šūmakaris et al., 2020; 2021; 2023); two papers in the international conference proceedings (Šūmakaris & Korsakienė, 2021; 2022). The results were presented at four scientific conferences:

- Contemporary Issues in Business, Management and Economics Engineering 2021: the 11th International Scientific Conference, 2021-05-13, Vilnius, Lithuania;
- Business and Management 2022: the 12th International Scientific Conference, 2022-05-12, Vilnius, Lithuania;
- Scientific Conference on Economics and Entrepreneurship 2022: the 63rd International Scientific Conference, 2022-10-13, Riga, Latvia;
- Business and Management 2023: the 13th International Scientific Conference, 2023-05-11, Vilnius, Lithuania.

The final results of the dissertation were presented at the scientific seminar, 2023-10-12, Riga Technical University, Riga, Latvia.

The Structure of the Dissertation

The dissertation consists of an introduction, three chapters, general conclusions, a list of references, a list of the author's publications, a summary in Lithuanian, and six annexes (A, B, C, D, E, and F). The dissertation consists of 134 pages, excluding references and annexes, 28 figures, 51 tables, and 254 references.

1

Theoretical Framework for Eco-Innovation Strategies in the Development of Internationalization

The First Chapter presents the conceptualization of the four main pillars of this dissertation: eco-innovation, eco-innovation strategy, internationalization, and strategic decision-making. The focus is on investigating the problematic and theoretical aspects of the eco-innovation strategy in the international development of business companies. Each section aims to disclose specific concepts included in further investigation. Conceptualization is based on prevailing viewpoints and theoretical scientific approaches. The chapter concludes by formulating the theoretical framework for selecting an eco-innovation strategy in the pre-internationalization phase and a hierarchical structure of the decision problem, which serves as a starting point for empirical research.

The findings related to this chapter have been published in four scientific publications (Šūmakaris et al., 2020; 2021; 2023; Šūmakaris & Korsakienė, 2021).

1.1. Conceptualization of Eco-Innovation and Eco-Innovation Adoption

Currently, one of the most important strategic tools for gaining sustainable competitive advantage is eco-innovation (Zameer et al., 2022). To better understand the concept of eco-innovation, it is worth investigating both compound terms (that is, "eco" and "innovation"). First, the "eco" in eco-innovation is based on the "traditional innovation with a reduction of environmental impact" (Peiró-Signes & Segarra-Oña, 2018), and any innovation could be an eco-innovation as long as it is more environmentally friendly than the relevant alternative (Kemp & Pearson, 2007).

The traditional innovation concept is derived primarily from the management and economic disciplines. The management perspective covers how innovation can change a firm's position in the market, while the economic perspective examines why organizations innovate and the economic effects of innovation in an industry, market or economy (OECD/Eurostat, 2018). From the innovation evolutionary perspective, Xu et al. (2006) illustrated the development course of innovation theory, which consists of five different phases throughout different periods (Xu et al., 2006). The initial phase was started when Schumpeter's (1934) ideas and theory of economic development emphasized the role of innovation in economic and social change. Notably, the inspirations of Schumpeter's (1934) theories explain how firms search for new opportunities and competitive advantage by introducing innovations that create new ways of producing goods or services or entirely new industries (Hellström, 2007). Moreover, the diffusion of innovations theory (Rogers, 1962) considers the processes by which firms communicate and adopt innovations. Rogers (1962) defined diffusion of innovation as "the process by which an innovation is communicated through certain channels over time among the members of a social system". Furthermore, according to Karakaya et al. (2014), this definition contains four elements: (1) the innovation, (2) the communication channels, (3) the time, and (4) the social system. Notably, the diffusion of innovation theory explains that firms adopt innovations at different rates (Greenhalgh et al., 2004) and, thus, are distinguished into: (1) innovators, (2) early adopters, (3) early majority, (4) late majority, and (5) laggards. The scholars observed that the adoption process heavily relies on the firm's internal resources and social capital (Frank et al., 2004). Additionally, the understanding of the diffusion of eco-innovations recently has gained more importance, given the fact that some eco-innovations are already at a mature stage (Karakaya et al., 2014). Empirical evidence revealed that some eco-innovations require a lengthy period before adoption, which is directly related to their diffusion rate and path (Karakaya et al., 2014).

Xu et al. (2006) suggested to focus on the interactive mechanisms and relationships among the components of innovation. Therefore, based on the system

theory (originally developed by von Bertalanffy in 1968), some scholars shifted the research focus from individual components in the innovation system to the interactive relationships of these components, i.e., innovation as a system (Bouwer, 2017). Therefore, Bouwer (2017) defines innovation as a system where multidisciplinary capabilities (knowledge, skills, and resources) are integrated to provide new insights as unique solutions, which customers or consumers will value in such a way that the company will generate brand recognition in the market, wealth for employees, and growth for stakeholders. Consequently, impacts and interactions between different actors in the innovation ecosystem are examined (Warnke et al., 2016). However, in the fast-changing consumer demand economy, innovation management researchers have had to make a significant shift in their research to look at theories that can deliver on these new requirements (Bouwer, 2017). Furthermore, companies could no longer afford to rely entirely on their ideas to advance their business; therefore, the concept of open innovation was introduced (Chesbrough, 2003) and further developed (Chesbrough, 2017). The open innovation paradigm suggests that firms must be linked to external knowledge actors to innovate successfully (Cricelli et al., 2016). Therefore, the concept of open innovation and the ability of the firm to exploit eco-innovations developed elsewhere are considered essential components of a successful eco-innovation strategy in the development of internationalization. As mentioned before, the primary focus is on adopting the eco-innovations that already exist in the market. However, on a global scale, the open innovation literature falls short of adequately addressing the international dimension, a crucial aspect of enhancing the performance of a firm's global activities (Sekliuckiene et al., 2016).

According to OECD/Eurostat (2018), the term "innovation" can be used in different contexts and refers to an activity or an outcome of the activity, where "activity includes all developmental, financial and commercial activities undertaken by a firm that is intended to result in an innovation for the firm" (i.e., research and development (R&D)); and "innovation" (that is, outcome) is defined as "a new or improved product or business process (or a combination thereof) that differs significantly from the previous products or business processes of the firm, and that has been introduced on the market or has been brought into use by the firm" (OECD/Eurostat, 2018). The clarification of the terms used in the definition of innovation is as follows: (1) a product is assumed to be a good or service (or a combination of both); (2) business processes are considered to be all core activities conducted by the firm to produce products and all ancillary or supporting activities; (3) the concept of "introduction" is defined as implementation and when a significantly different product or business process is first made available for use; (4) the concept of "significance" excludes minor changes, although it is highly subjective because it is relative to each firm's context, capabilities and requirements; (5) innovations can be developed by

a firm internally or some external provider, from which they are adopted. Therefore, the definition of innovation also includes diffusion (OECD/Eurostat, 2018).

When it comes to "eco" in eco-innovation, it is the fundamental difference compared to traditional innovation; hence, in this dissertation, only innovations with outcomes that reduce negative environmental impacts or deliver environmental benefits are investigated. In particular, eco-innovation generates a "win-win" setup characterized by the compatibility of economic development and a sustainable economy (Chen et al., 2012). The scholars suggest that eco-innovations are, on average, characterized by a higher degree of novelty as compared to other innovations (Cainelli et al., 2015) and are characterized by the so-called "double externality problem", which highlights the key role of existing environmental laws and other regulatory factors (regulatory push effect) and consumers' requests (demand-pull effect) to overcome the low incentive to eco-innovate (Rennings, 2000).

Eco-innovation originated from environmental problems that need urgent solutions and is aimed at reducing negative environmental impact (Franceschini et al., 2016). Very little research was conducted on the topic of eco-innovation prior to 1990 when the *Brundtland report*, commissioned by the United Nations (1987), defined the term "sustainable development" as "meeting the needs of the present without compromising the ability of future generations to meet their own needs". Subsequently, Fussler and James (1996) defined the concept of eco-innovation as "the supply of new products and processes to reduce the negative environmental impact and yield benefit for consumers and businesses". Consequently, this has triggered the exponential growth of scientific publications in this field (Šūmakaris et al., 2020). Although the term eco-innovation was defined in 1996, most eco-innovation-related publications were published after 2009 (Kuo & Smith, 2018). However, the concept of eco-innovation has been embedded in most sustainability research papers since 1990 (Kuo & Smith, 2018).

Developing eco-innovation-related studies involved various scholars with a wide spectrum of backgrounds. As a result, a multidisciplinary approach to eco-innovation in the scientific literature has led to various definitions and different terms. First, Schiederig et al. (2012) noted that four different terms, "eco/ecological", "environmental", "green", and "sustainable", which describe the same phenomenon, were used interchangeably in the scientific literature. However, Franceschini et al. (2016) concluded that the term "environmental innovation" covers any type of change that benefits the environment. Meanwhile, "eco-innovation" and "green innovation" are an intersection between economic and environmental innovation. Finally, "sustainable innovation" includes a social dimension. Therefore, based on the terminology clarification and reasoning by Franceschini et al. (2016), Oduro et al. (2022), and Schiederig et al. (2012), this dissertation further refers to "eco-innovation" and "green innovation" as similar terms. Nevertheless,

for clarity and readability, the term "eco-innovation" is used when referring to both "eco-innovation" and "green innovation".

Second, a variety of eco-innovation definitions has been suggested by various researchers. Table 1.1 presents the definitions of eco-innovation.

Table 1.1. Definitions of eco-innovation (source: created by the author)

Author(s), Year	**Definition of eco-innovation**
Rennings, 2000	All measures of relevant actors (firms, politicians, unions, associations, churches, private households) which: (1) develop new ideas, behavior, products and processes, apply or introduce them and (2) which contribute to a reduction of environmental burdens or to ecologically specified sustainability targets.
Kemp & Pearson, 2007	The production, assimilation or exploitation of a product, production process, service or management or business method that is novel to the organization (developing or adopting it) and which results, throughout its life cycle, in a reduction of environmental risk, pollution and other negative impacts of resources use (including energy use) compared to relevant alternatives.
European Commission, 2012	Any innovation resulting in significant progress towards the goal of sustainable development, by reducing the impacts of our production modes on the environment, enhancing nature's resilience to environmental pressures, or achieving more efficient and responsible use of natural resources.
Eco-Innovation Observatory, 2012	The introduction of any new or significantly improved product (good or service), process, organizational change or marketing solution that reduces the use of natural resources (including materials, energy, water and land) and decreases the release of harmful substances across the whole life-cycle.
Horbach et al., 2012	Product, process, marketing, and organizational innovations, leading to a noticeable reduction in environmental burdens. Positive environmental effects can be explicit goals or side-effects of innovations. They can occur within the respective companies or through customer use of products or services.
Arranz et al., 2019	Innovation in new products, services, or new business practices, is necessary to create new business opportunities and benefits for the environment and can be defined as a typology of innovation, which provides environmental benefits.
Oduro et al., 2022	A subclass of innovation associated with green products or processes, marketing techniques, organizational structures and systems or technologies that improve not only environmental performance but also the economic performance of innovators.

Referring to definitions of eco-innovation (Table 1.1) in general within the definitions, four fundamental components are as follows: (1) product or process innovation, which differs significantly from previous products or business processes of the firm and is novel to the organization (developing or adopting it); (2) environmental benefit, which is a reduction of environmental risk, pollution, waste and other negative impacts of resources use (including energy use); (3) economic benefit, which is economic performance for innovators, new business opportunities etc.,

and (4) introduction to the market or usage by the firm i.e., the organization makes a conscious decision to adopt eco-innovation.

Thus, all four components are considered essential to fit the scope of the dissertation. Eco-innovation is considered a subclass of innovation and an intersection between economic and environmental innovation. Such conceptualization of eco-innovation outcomes is in line with previous studies that investigated eco-innovation (Hojnik & Ruzzier, 2016; Kemp & Pearson, 2007). The following definition of eco-innovation is proposed: a new or improved product or business process (or combination thereof) that differs significantly from previous products or business processes of the firm and results in both economic performance for innovators and in a reduction of environmental impact or delivers environmental benefits, and a firm has made a conscious decision to introduce it to the market or bring it to use by the firm. Respectively, the following terms are used: "product eco-innovation" (hereinafter – eco-product) when considering product innovation and "process eco-innovation" (hereinafter – eco-process) when considering process innovation. For instance, adjusting operational activities to reduce resource waste and pollution emissions (Wang et al., 2021) and environmental management systems (EMS) are typical examples of business eco-process innovation (Rennings & Rammer, 2009). Whereas any environmental benefits related to the product are considered eco-product innovation, such as the development of environment-friendly products to replace traditional products (Wang et al., 2021), improvement of environment-friendly packaging, etc. (Hojnik & Ruzzier, 2017).

In the scientific literature, the concept of eco-innovation is investigated mainly from two perspectives. First, scientific literature investigates eco-innovation and considers eco-innovation as a tool for economic and financial growth, gaining competitive advantage, improving environmental performance, and sustainable development from the country-level perspective (Urbaniec & Tomala, 2021); industry-level (Ullah et al., 2022); or firm-level (Zameer et al., 2022). Thus, given the aim and formulated problem, the primary focus of this dissertation is the firm-level environment.

Second, in addition to the levels mentioned above, the scientific literature investigates eco-innovation from the perspective of hindering and driving factors (Cai & Li, 2018; Kiefer et al., 2019). In particular, hindering and driving factors are investigated from the perspectives of R&D (De Marchi, 2012) and eco-innovation adoption (Vagnani et al., 2019). Furthermore, the traditional analysis of driving and hindering factors is usually referred to as push/pull factors when push factors include infrastructure measures or subsidies that promote eco-innovation. Meanwhile, pull factors emphasize the role of consumer demand and firm and government demand as determinants of eco-innovation (Rennings & Rammer, 2009). For example, the new technology (i.e., push) solves environmental problems in firms, while environmental regulation, policy, social pressure push/pull and market demand pull

are responsible for these environmental improvements (Arranz et al., 2019; Horbach et al., 2012). Jové-Llopis and Segarra-Blasco (2018) state that a theory of innovation, which includes push and pull factors as the main drivers of eco-innovation, is not comprehensive enough when it comes to the decision to implement an eco-innovation and, most importantly, an eco-innovation strategy. Simply put, the factors that drive business companies toward the adoption of eco-innovation might not be considered in the decision-making process when the company is deciding "if eco-innovation should be implemented" or in the process of selecting "which eco-innovation" should be implemented to gain competitive advantage in international markets. Therefore, different factors are at play when firms are being driven to implement eco-innovations compared to factors that are being evaluated in the decision-making process.

Eco-innovation is a multi-stage phenomenon, and drawing upon the traditional innovation stage view (Silva et al., 2016), any innovation goes through three stages:

1. Idea (or invention of "something new", i.e., the concept or prototype);
2. Development ("doing" of "something new", i.e., production of a new product or process);
3. Commercialization (diffusion, "selling" of "something new", i.e., introducing to the market or implementing by the firm).

The third step is realization, which is based on the fundamental feature of innovation that differentiates it from invention – new knowledge creation and implementation in real-world practice (Kemp & Pearson, 2007). Furthermore, Kemp and Pearson (2007) presented eco-innovating companies' classification depending on how each firm innovates (by developing innovations for other firms, adopting innovations developed elsewhere strategically or passively), which is based on previously proposed classification by Hollanders and Arundel (2004). Kemp and Pearson (2007) distinguished all innovative firms into four mutually exclusive categories: (1) strategic eco-innovators, which are active in eco-innovation development (creating); (2) strategic eco-adopters, which intentionally implement eco-innovations either developed by themselves, adopted from other firms, or both; (3) passive eco-adopters, which do not have specific strategy, although they implement eco-innovations that result in environmental benefits; (4) non-eco-innovators, which do not develop or implement innovations with environmental benefits.

Since the main focus of this dissertation is to model a firm's decision-making in the eco-innovation strategy selection process to gain competitive advantage in international markets, the diffusion and adoption stages are considered primary and essential, compared to innovation activity (R&D). Thus, further in this dissertation, when referring to an eco-innovation, it is considered from the perspective of the result (the outcome and not the R&D) because strategic adopting of eco-innovations that are developed mainly by external partners (or elsewhere) is the most significant

to gain competitive advantage in the international market. Due to the fact that empirical evidence (Nunes et al., 2012; Park et al., 2021; Stam & Wennberg, 2009) points that eco-innovation development (that is, R&D expenditures) is a high-risk high-return strategy, which only high-tech firms are capable of pursuing. Furthermore, when it comes to non-high-tech firms, the development of eco-innovation (from the R&D perspective) does not improve the firm's performance and restrict growth or does not affect the growth rate of firms. Moreover, Vagnani et al. (2019) argued that the decision to adopt an eco-innovation in organizations is important since most eco-innovations in organizations result from borrowing rather than inventing.

The scientific literature uses the terms "eco-innovation realization", "eco-innovation implementation", "eco-innovation adoption", and "eco-innovation introduction" interchangeably and refers to the decision of the organization to use eco-innovation developed elsewhere for the best course of action of the entire organization, as a productive resource and to achieve superior performance (Chappin et al., 2020; Rogers, 1962; Vagnani et al., 2019). Thus, all notions suggest that eco-innovation has been developed mainly by external partners rather than by the firms themselves and is being realized and put to use (Cainelli et al., 2015). Nevertheless, for clarity and readability purposes, this dissertation uses the term "eco-innovation adoption" interchangeably with "eco-innovation implementation", "eco-innovation introduction", "eco-innovation realization", etc. Furthermore, a developed or adopted eco-innovation may be new to the world or new to the company. Thus, innovation must contain characteristics that were not previously made available by the relevant organization to its users (OECD/Eurostat, 2018). The concept is in line with the diffusion of innovation theory (Rogers, 1962). Therefore, the adoption of a new process or business practice developed elsewhere "counts as innovation" (Kemp & Pearson, 2007).

In summarizing the analysis of scientific literature exploring the phenomenon of eco-innovations, several essential approaches are chosen. First, eco-innovation is considered to be a subclass of innovation that reduces negative environmental impacts or delivers environmental benefits; however, the economic dimension is as essential as the environmental dimension and is conceptualized as an intersection between economic and environmental dimensions. Second, the adoption of eco-innovation that is new to the firm and is developed elsewhere and not by the firm itself is considered to be an essential component for the conceptualization of the eco-innovation strategy and different typologies of eco-innovation strategies since the R&D requires exceptional company resources and capabilities that not many companies possess, and most importantly, some eco-innovations are already at a mature stage and widely available.

Considering the broad spectrum of eco-innovation outcomes that involve the reduction of negative environmental impacts or delivering environmental benefits

for both process and product eco-innovations, it is important to distinguish distinct types of eco-innovation to conceptualize a strategic approach to eco-innovation.

1.2. Distinct Types of Eco-Innovation

Despite a high academic interest in eco-innovation, a clearly defined common understanding of the different types of eco-innovation is still missing (Kiefer et al., 2017). Different types of eco-innovation have been mentioned in scientific literature, and the most common approach to distinguish different types of eco-innovation is by process versus product (Wang et al., 2021). The classification of eco-innovation by product or process was influenced by the revised definition of business innovation in the Oslo Manual 2018 (OECD/Eurostat, 2018), changing the previous four types (product, process, organizational and marketing) to two main types, i.e., product innovations and business process innovations. First, a product innovation "is a new or improved good or service that differs significantly from the firm's previous goods or services and that has been introduced on the market"; second, a process innovation "is a new or improved business process for one or more business functions that differs significantly from the firm's previous business processes and that has been brought into use by the firm" (OECD/Eurostat, 2018).

Another classical approach to distinguishing different types of eco-innovation is based on the traditional radical versus incremental approach when radical eco-innovation is defined as a new or significantly improved product or service with environmental benefits which are new to the market, while incremental eco-innovation is new to the firm (Hellström, 2007; Mothe & Nguyen-Thi, 2017). Similarly, according to OECD (2012), three distinct types of eco-innovations are (1) incremental, which aims at modifying and improving existing technologies or processes to raise the efficiency of resource and energy use without fundamentally changing the underlying core technologies; (2) disruptive, which changes how things are done or specific functions are fulfilled, without necessarily changing the underlying technological regime itself. Examples, such as the change from incandescent to fluorescent lighting, fall within the disruptive eco-innovation category; and (3) radical, which involves a shift in the technological regime of the economy and can lead to changes in the economy's enabling technologies.

Other few novel approaches are provided by Kiefer et al. (2017), which distinguish eco-innovations by four dimensions (design, user, product service, and governance); five dimensions (systemic, externally driven, continuous improvement, radical and technology-push, eco-efficient) (Kiefer et al., 2019); five dimensions (product, process, technological, and organizational and green patents) (Marín-Vi-

nuesa et al., 2020). However, all mentioned novel approaches investigated eco-innovation from the perspective of driving factors and the type of driving factors that affect different types of eco-innovation. In contrast, when different types of eco-innovation outcomes are considered, different types of eco-innovation typologies emerge.

When it comes to eco-innovation outcomes, it would be incorrect to consider all eco-innovation to be homogeneous because eco-innovation can be decomposed into at least two typologies based on the diverse results it brings (Ghisetti & Rennings, 2014). First, eco-innovation can have a diverse effect through the reduction of environmental pollution (hereinafter – environmental eco-innovation) or second, the reduction of energy and/or material use (hereinafter – energy eco-innovation) (Ghisetti & Rennings, 2014; Rennings & Rammer, 2009; Šūmakaris et al., 2021). Some authors refer to energy eco-innovation as "energy and resource efficiency innovation" (Ghisetti & Rennings, 2014; Rennings & Rammer, 2009); however, for clarity and readability purposes, this dissertation uses the terms "environmental eco-innovation" and "energy eco-innovation". The scientific literature investigates energy eco-innovation as a specific subset of eco-innovation (Šūmakaris et al., 2021; Walton et al., 2020), and the distinctive feature of energy eco-innovation in comparison to environmental eco-innovation lies in the notion that this type of eco-innovation brings environmental benefits by increasing energy and resource efficiency (Rennings & Rammer, 2009).

Therefore, distinguishing different types of resulting benefits of eco-innovation allowed various empirical studies to separately investigate energy eco-innovation and environmental eco-innovation (Šūmakaris et al., 2021). One of the most popular classifications of the resulting benefits of eco-innovation used in the scientific community is based on the data provided by the Community Innovation Surveys (CIS), which are a series of surveys on innovation in enterprises executed regularly (biennial) by national statistical offices throughout the European Union (Doran & Ryan, 2016).

The classification of environmental benefits slightly varies by the date the CIS was conducted; however, the classification of resulting benefits of eco-innovation according to the two types of eco-innovation are presented in Table 1.2.

The scholars revealed that energy eco-innovation could significantly affect the firm's profitability compared to environmental eco-innovation (Ghisetti & Rennings, 2014; Rexhäuser & Rammer, 2014). Eco-innovations that increase the firm's efficiency of resources in terms of material or energy consumption per unit of output have a positive impact on profitability. Meanwhile, other eco-innovations, which do not improve firms' resource efficiency, do not provide profitability-positive returns (Rexhäuser & Rammer, 2014).

Table 1.2. Environmental benefits according to the types of eco-innovation (source: created by the author)

Environmental benefits obtained within the enterprise	**Type**	**Author(s), year**
Reduced material or water use per unit of output	Energy	Doran & Ryan, 2016; Ghisetti & Rennings, 2014; Rennings & Rammer, 2009; Rexhäuser & Rammer, 2014
Reduced energy use or CO^2 "footprint" (i.e., reduced total CO^2 emission)	Energy	Arranz et al., 2021; Capozza et al., 2021; Caravella & Crespi, 2020; Doran & Ryan, 2016; Ghisetti & Rennings, 2014; Jové-Llopis & Segarra-Blasco, 2018; Rennings & Rammer, 2009; Rexhäuser & Rammer, 2014; Segarra-Blasco & Jové-Llopis, 2019
Reduced soil, noise, water or air pollution	Environmental	Arranz et al., 2021; Caravella & Crespi, 2020; Doran & Ryan, 2016; Ghisetti & Rennings, 2014; Jové-Llopis & Segarra-Blasco, 2018; Rexhäuser & Rammer, 2014
Replaced a share of materials with less polluting or hazardous substitutes	Environmental	Arranz et al., 2021; Caravella & Crespi, 2020; Doran & Ryan, 2016; Ghisetti & Rennings, 2014; Jové-Llopis & Segarra-Blasco, 2018; Rexhäuser & Rammer, 2014; Segarra-Blasco & Jové-Llopis, 2019
Replaced a share of fossil energy with renewable energy sources	Environmental	Capozza et al., 2021; Caravella & Crespi, 2020; Ghisetti & Rennings, 2014; Rexhäuser & Rammer, 2014
Recycled waste, water, or materials for own use or sale	Energy	Caravella & Crespi, 2020; Doran & Ryan, 2016; Ghisetti & Rennings, 2014; Rexhäuser & Rammer, 2014
Environmental benefits obtained during the consumption or use of a good or service by the end-user	**Type**	**Author(s), year**
Reduced energy use or CO^2 "footprint"	Energy	Arranz et al., 2021; Capozza et al., 2021; Caravella & Crespi, 2020; Doran & Ryan, 2016; Ghisetti & Rennings, 2014; Jové-Llopis & Segarra-Blasco, 2018; Rennings & Rammer, 2009; Rexhäuser & Rammer, 2014; Segarra-Blasco & Jové-Llopis, 2019
Reduced air, water, soil or noise pollution	Environmental	Arranz et al., 2021; Caravella & Crespi, 2020; Doran & Ryan, 2016; Ghisetti & Rennings, 2014; Jové-Llopis & Segarra-Blasco, 2018; Rexhäuser & Rammer, 2014
Facilitated recycling of product after use	Environmental	Caravella & Crespi, 2020; Doran & Ryan, 2016; Ghisetti & Rennings, 2014; Rexhäuser & Rammer, 2014
Extended product life through longer-lasting, more durable products	Environmental	Caravella & Crespi, 2020

Although environmental eco-innovation proves to be profitable over time due to environmental regulations, the short-term outcomes may not be as apparent (Ghisetti & Rennings, 2014). Hence, innovations geared toward energy efficiency contribute positively to profitability, creating a "win–win" scenario where environmental impact is diminished while enhancing the economic performance of firms (Ghisetti & Rennings, 2014; Rennings & Rammer, 2009).

Furthermore, empirical findings substantiate the inherent differences between energy eco-innovation and environmental eco-innovation, either in terms of drivers and productivity or in barriers (Ghisetti & Rennings, 2014; Jové-Llopis & Segarra-Blasco, 2018). However, both types of eco-innovation face the "double externality problem" typical for eco-innovation (Jové-Llopis & Segarra-Blasco, 2018; Moreno-Mondéjar & Cuerva, 2020; Rennings & Rammer, 2009) and reduce the negative environmental impact.

The scientific studies on two distinct types of eco-innovations are still very limited. However, studies that investigated separate environmental benefits of eco-innovation have provided a solid theoretical basis to distinguish two types of eco-innovation that are further used for this dissertation:

1. *Environmental eco-innovation is the type of eco-innovation that provides effects and consists of the reduction of externalities such as air, water, noise, soil pollution, and harmful materials and/or innovation that facilitates the recycling of the product after use and/or extended product life.*
2. *Energy eco-innovation is the type of eco-innovation that provides effects and consists of material and/or energy reduction (including reduction of CO^2) used per unit of output and/ or recycled waste, water, or materials for own use or sale by an enterprise and/ or innovation that reduces energy (including reduction of CO^2) by the end user.*

Eco-innovations that improve recycling possibilities are assigned to energy eco-innovation since they save resources for their use or sale. However, eco-innovation that facilitates the recycling of products after use (i.e., the environmental benefit obtained by the end-user) is assigned to environmental eco-innovation due to the reduced environmental impact. Likewise, eco-innovation that benefits end customers with extended product life through longer-lasting, more durable products is also considered environmental eco-innovation. The CO^2 emission reduction dimension is assigned to energy eco-innovation (and not environmental eco-innovation) as it is not feasible to pursue any CO^2 emission reduction without energy efficiency improvements as the major driver of CO^2 emissions comes from the energy mix used (Ghisetti & Rennings, 2014; Rexhäuser & Rammer, 2014).

In summary, the analysis of the scientific literature investigating distinct eco-innovation types confirms a variety of ways to distinguish eco-innovations. Nevertheless, there is no unified and clearly defined common understanding of the dif-

ferent types of eco-innovations. With that in mind and considering the broad spectrum of eco-innovation outcomes, Figure 1.1 presents the main types of eco-innovation that are further used in this dissertation. First, drawing upon a common approach, the conceptualization includes process versus product eco-innovations. Second, based on the resulting benefits of eco-innovation, the conceptualization includes environmental eco-innovations versus energy eco-innovations.

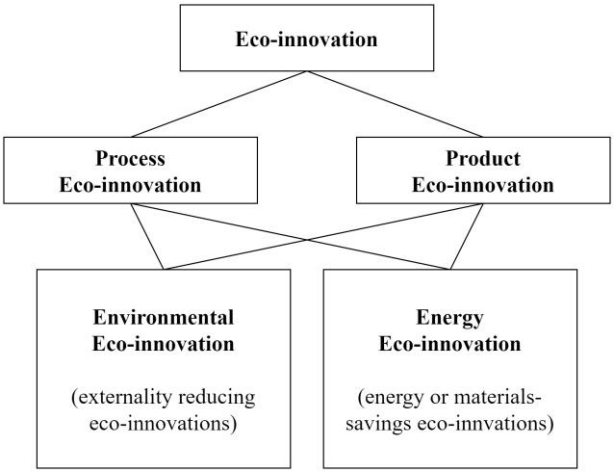


Fig. 1.1. Distinct types of eco-innovation (source: created by the author)

However, empirical evidence shows (Peiró-Signes & Segarra-Oña, 2018) that a firm's environmental orientation and behavior toward eco-innovation are long-term issues, emphasizing timely alignment of management decisions, company strategy, and clarity of long-term objectives concerning environmental orientation results in better company performance. Therefore, it is important to approach eco-innovations from a strategic perspective.

1.3. Conceptualization of Eco-Innovation Strategy and Eco-Innovation Strategy Typologies

Although there is considerable significance and scholarly interest in the domain of eco-innovation, the realm of eco-innovation strategies has not undergone a comprehensive exploration within the scientific literature. The inherent complexity and lack of clarity persist in understanding the general nature of eco-innovation strategies (López Pérez et al., 2023; Luan et al., 2023; Shukla, 2019). As noted by Shukla (2019), the scientific literature lacks a consensus regarding the common

theoretical framework pertinent to eco-innovation strategy. There is a shortage of studies on the phenomenon of eco-innovation from organizational management and strategic perspectives (Tamayo-Orbegozo et al., 2017), and most studies investigate eco-innovation from the perspective of solitary solution and isolated practices and non-strategic approach (Janahi et al., 2021). Furthermore, studies investigating eco-innovation as a strategy are very fragmented and neglect the ambidexterity of eco-innovation (Luan et al., 2023; Sun & Sun, 2021). Notably, scientific investigations focused on the strategic approach to eco-innovation are scarce (Janahi et al., 2021), and eco-innovation as an integral strategy of business companies in the development of internationalization has been neglected in the scientific literature.

However, an increasing number of studies incorporate fundamental strategic management theories into studies investigating eco-innovation. The strategic management theories applied in studying eco-innovation and considered essential for this dissertation are as follows.

First, the resource-based view (RBV), originally developed by Barney (1991), emphasizes the importance of firm resources that help a firm achieve a sustained competitive advantage, especially resources that are valuable, rare and difficult to imitate, replicate, or substitute. Subsequently, Hart (1995) introduced the natural resource-based view (NRBV) based on RBV by incorporating the natural environment in the framework and confirmed that firm resources and certain capabilities of pollution control and sustainable management stimulate firm growth. Hart (1995) debated that environmental-related capabilities can be considered unique resources, helping them achieve competitive advantage (Do & Nguyen, 2020). Recent studies based on RBV and NRBV from the perspective of firm resources and capabilities highlighted the positive effects of eco-innovation on a firm's competitive advantage (Cainelli et al., 2015; Do & Nguyen, 2020). Second, the dynamic capabilities theory originally proposed by Teece et al. (1997) as an extension of the RBV was conceptualized as "the firm's ability to integrate, build, and reconfigure internal and external competencies to address rapidly changing environments". Dynamic capabilities encompass the management of capabilities and resources of all functions of firms, with the final objective of obtaining a competitive advantage (Arranz et al., 2020). Theory reflects an organization's ability to achieve new and innovative forms of competitive advantage given the dependencies of the path and the market position. Subsequent studies specifically emphasized the green aspect in dynamic capability theory with a specific focus on capabilities related to eco-innovation and its importance to competitive advantage (Chen et al., 2015; Dangelico et al., 2017; Lin & Chen, 2017; Yousaf, 2021). Third, the absorptive capacity theory was originally proposed by Cohen and Levinthal (1990) and conceptualized as "the ability of a firm to per-

ceive the value of new data, integrate that data, and apply it to commercial purposes". The absorptive capacity theory emphasizes organizational learning, knowledge innovation, application of knowledge assets and dynamic knowledge integration (Chen et al., 2015). Subsequent studies specifically emphasized the green aspect in absorptive capacity theory with a specific focus on eco-innovation and how firm competencies and knowledge accumulation capabilities affect the eco-innovation of firms (Aboelmaged & Hashem, 2019; Albort-Morant et al., 2018; Chen et al., 2015; Solnørdal & Thyholdt, 2019).

The importance of eco-innovation and the necessity to include eco-innovation in business strategies are widely discussed. To remain competitive in markets, companies must address growing environmental awareness, increasing consumer demands, and global regulations for eco-friendly products and processes (Qing et al., 2022). This involves integrating environmental considerations into strategic planning and adopting eco-friendly business strategies, making eco-innovation a necessity rather than a choice (Hojnik et al., 2018). While competition rises to a new level, organizations are pushed to compete in multiple dimensions and create new green business strategies. Moreover, the topic of sustainable development has increasingly become relevant for organizations aiming to satisfy environmental needs, comply with environmental regulations, differentiate among competitors and gain sustainable competitive advantages (Albort-Morant et al., 2017). Hence, environmental policies and incentives typically arise at the macro level, and market demand is associated with the meso level, whereas the realization of eco-innovation is observed at the micro level (Allacker et al., 2019). Companies that align their strategy, resources, capabilities, culture, and knowledge with eco-innovation not only comply with environmental requirements, but also establish barriers to competitors, improve production efficiency, and expand to new markets (Albort-Morant et al., 2017). Consequently, in contemporary business practice, eco-innovations emerge as crucial strategic tools to attain sustainable competitive advantage (Zameer et al., 2022). Moreover, Martínez-Ros and Merino (2023) suggested that companies wishing to compete in international markets have to think strategically and introduce eco-innovation into their planning.

In the realm of empirical research on eco-innovation strategies, the existing body of literature presents certain ambiguities. The scientific literature contains a degree of interconnection between the definitions and metrics of environmental strategies, often referred to as green, ecological and sustainable strategies, and eco-innovation strategies (Caravella & Crespi, 2022; Wang et al., 2022). Two pioneering studies have significantly influenced subsequent research on eco-innovation strategies and have served as catalysts for further investigations. The first of these pivotal contributions was conducted by Chan (2005), who, drawing upon the NRBV, introduced a framework for measuring environmental strategies. The second influential work was conducted by Eiadat et al. (2008), who put forward

the initial definition of an eco-innovation strategy and investigated the links between the adoption of an eco-innovation strategy and the competitive advantage of firms. Despite the substantial impact of these two studies on the field of eco-innovation strategy, the need remains to establish a distinct conceptual framework for eco-innovation strategy that can be delineated from environmental strategy (Janahi et al., 2021; Šūmakaris et al., 2023). Therefore, to formulate a conceptual understanding of an eco-innovation strategy, it is imperative to first briefly explore the essence of the strategy itself.

The discipline of strategic management originated in the 1960s (Barbosa & Romero, 2016) and in common terminology "strategy" refers to a "long-term plan" or a pattern in a stream of decisions (Mintzberg, 1978). According to one of the most prominent contributors to the field, Chandler (1962), a strategy is "the determination of the basic long-term goals and objectives of an enterprise, and the adoption of courses of action and the allocation of resources necessary for carrying out these goals". Furthermore, a business strategy includes the formulation of goals and the identification of policies to reach these goals. Strategic goals cover the intended outcomes over the mid and long term. Strategic policies or plans include how an organization creates a competitive advantage or a "unique selling proposition" (OECD/Eurostat, 2018).

To conceptualize the eco-innovation strategy, this dissertation aligns with the above-mentioned Chandler (1962) and OECD/Eurostat (2018) propositions and the rationale presented in the research conducted by Walton et al. (2020) on organizational strategic capabilities that affect eco-innovations. The argument is that a strategic approach to eco-innovation fundamentally diverges from a non-strategic approach in that the former necessitates (1) a strategy of continuous improvement in the firm and (2) integration of eco-innovation across the whole firm so that the outcome is to have a system-level change at the firm level (Walton et al., 2020). Moreover, according to Walton et al. (2020), isolated and standalone eco-innovation practices do not generate a competitive advantage for the firm and recommend integrating eco-innovations across the whole firm. Furthermore, as argued by Pham et al. (2019), the contemporary approach to strategic eco-innovation management is transitioning from simply selecting the best eco-innovation practices based on rankings and competitiveness to choosing a set of eco-innovation solutions that align most effectively with the firm's strategic objectives to deliver future benefits. Therefore, this dissertation posits its initial assertion that isolated and standalone eco-innovation practices, such as the implementation of new environmental management systems or the introduction of new environmentally friendly product enhancements, should not be equated with the eco-innovation strategy. Moreover, adopting a non-strategic approach to eco-innovation and failing to conduct a thorough assessment and selection of a suitable eco-innovation strategy can lead to enduring adverse outcomes. As indicated by Wijethilake

et al. (2018), these long-term consequences can include loss of valuable resources and customers, reduced competitiveness, ineffective expenditure on isolated and non-synergetic eco-innovation practices that are widely dispersed throughout the firm, and ultimately, a decline in organizational performance and reputation.

Regarding the definition of an eco-innovation strategy, current definitions are notably constrained, frequently overlap with an organization's environmental strategy and fall short of encompassing the full scope of the strategic dimension. A compilation of these definitions of eco-innovation strategy is provided in Table 1.3.

Table 1.3. Eco-innovation strategy definitions (source: created by the author)

Author(s), Year	**Eco-innovation strategy definition**
Eiadat et al., 2008	A class of manufacturing practices that include source reduction, pollution prevention, and the adoption of an environmental management system.
Huang & Li, 2018	The development of green product-related and green process-related innovation strategy and indicates strategic choices and decisions related to the adoption of green practices and environmental management systems.
Ge et al., 2018	The process in which an enterprise adopts green technology or green management to improve or change its production and operation activities to achieve the goals of reducing environmental pollution, conserving resources, reducing waste and improving the environment in alignment with the external environment and the condition of the organization.
Liao & Tsai, 2019	The decision making done by a firm in the scope of environmental benefits to react to the changing reality (e.g., environmental pressures).
Janahi et al., 2021	A set of actions and commitments by manufacturing firms for realizing innovation that targets and boosts sustainable development.
Lin et al., 2021	Innovative activities which decrease a firm's effect on the ecosystem, thereby allowing the organization to achieve its eco-targets and environmental benefits while also building its competitive advantage.

Referring to the above-presented definitions, in general, six components can be distinguished: (1) eco-innovation adoption or realization; (2) eco-innovation development; (3) environmental or sustainable outcome; (4) strategic choices and decisions related to eco-innovation; (5) reaction to environmental pressures; and (6) economic or competitive advantage outcome. Arguably, to fit the scope of the dissertation, five out of six components are considered essential (excluding the eco-innovation development). However, neither of the above-presented eco-innovation strategy definitions covers an entire area of the strategic approach to eco-innovation, which includes previously mentioned essential components, such as continuous improvement and integration of a set of eco-innovations throughout the firm

so that the outcomes have a system-level change at the firm level with both economic and environmental outcomes. Furthermore, this dissertation posits its following assertion and conceptualizes the eco-innovation strategy from the perspective of the strategic green transformation of the firm, and it is essential to include all the components.

Therefore, drawing upon the rationale presented above and the fundamental theories of strategic management, this dissertation emphasizes the strategic approach to eco-innovation management and the strategic green transformation of products or processes of an organization through the adoption of a set of eco-innovation, compared to isolated and solitary eco-innovation solutions, to gain competitive advantage in international markets. A novel definition of an eco-innovation strategy is proposed as follows:

The eco-innovation strategy integrates the strategic decisions of an organization that are based on continuous improvement and strategic green transformation through the implementation of a set of eco-innovations to enhance the performance of the firm in its external environments.

The proposed concept of eco-innovation strategy puts the main emphasis on continuous improvement and integration of a set of eco-innovation that specifically targets the green transformation of products or processes of firms and is published in the scientific article (Šūmakaris et al., 2023).

Several key aspects related to the proposed concept of eco-innovation strategy are important to highlight. First, this dissertation adopts the view toward competitive advantage (Ge et al., 2018), which includes both financial indicators (i.e., sales, profit, market share, return on sales, growth, etc.) and non-financial indicators (i.e., customer satisfaction, customer loyalty, company reputation, etc.), and when referring to competitive advantage, it is considered as one of the main outcomes of the eco-innovation strategy and strategic green transformation. Second, in terms of the integration of a set of eco-innovations throughout the firm so that the outcomes have a system-level change, the integration comes when the eco-innovation concept (both environmental and economic dimensions) is a part of decision-making, value of all business units, functions and reporting structures (Sroufe, 2017). As a reference point, this dissertation suggests adopting a green business value chain framework, proposed by Hasan et al. (2019) for business units that need to be considered in the implementation of the eco-innovation strategy and the transformation of the traditional business value chain to the green business value chain. Third, the aspect of "continuous improvement" embodies the organization's strategic rather than tactical approach and must be disclosed in organizational statements (e.g., vision, mission, declaration) (Pham et al., 2019).

Consequently, the proposed concept of an eco-innovation strategy can be contrasted with the existing body of literature on eco-innovation strategies (and studies that juxtapose environmental and similar strategies).

In general, the scientific literature on studies of an eco-innovation strategy tends to present two perspectives. The first perspective that regards eco-innovation strategy as an interconnection with the environmental strategy is when eco-innovations are considered as a tool in the execution of a firm's environmental strategy, with the primary objective of reducing negative environmental impacts (Tsai & Liao, 2017; Jiang et al., 2019). Few authors refer to the proactive environmental (or sustainable) strategy (Do & Nguyen, 2020), which mainly embodies the organization's environmental orientation toward eco-innovation. However, the argument put forth by this dissertation maintains that the eco-innovation strategy fundamentally diverges from the environmental strategy. In essence, eco-innovation strategy is underpinned by a core principle of strategic green transformation and enhancing competitive advantage, which encompasses both economic and environmental dimensions, contrasting with studies on environmental strategies that primarily consider the environmental performance of a firm as an expected outcome.

Second, eco-innovation strategy is considered as a green strategic orientation or an R&D strategy with an environmental orientation and as a source of green organizational identity and green creativity (Alnaim et al., 2022), green learning and knowledge sharing (Wang et al., 2022; Zhang et al., 2022), green intellectual capital (Dang & Wang, 2022), etc. However, it is crucial to emphasize that the firm's environmental orientation or an R&D strategy oriented toward environmental concerns does not equate to an eco-innovation strategy. First, R&D activities require substantial investments, and even companies that allocate significant resources to internal R&D more than often rely on cooperation with external partners to diversify risks or gain access to competencies, which compensates for limitations related to internal R&D limitations (Solnørdal & Thyholdt, 2019). However, most companies do not possess such resources, and typically, more radical eco-innovations require more fundamental R&D activities (Kiefer et al., 2019). This, by nature, suggests that such an approach is more of a cooperation strategy with an environmental orientation rather than an eco-innovation strategy that is dedicated to gaining a competitive advantage. Second, as mentioned previously, empirical evidence confirms that R&D is a highly risky activity and expenditures do not always or immediately improve a firm's competitive advantage or performance (Park et al., 2021; Tsai & Liao, 2017).

Thus, once it is established that an eco-innovation strategy should deliver a competitive advantage to business companies, the generic competitive strategies, i.e., cost-leadership and differentiation initially put forth by Porter (1985), become pertinent and worthy of consideration. In this context, the eco-innovation strategy aligns with these generic competitive strategies for a more profound conceptualization of the typologies of eco-innovation strategy. The explanation lies in the

fact that the major strategic choice at the business level competes on price or quality (OECD/Eurostat, 2018). Quality-focused firms tend to develop new-to-market product innovations, whereas price-focused firms tend to focus on efficient processes and resource savings. Few scientific studies (Ahmed et al., 2021; Chen & Liu, 2018; Liao, 2016; Wang et al., 2020) have already employed the generic competitive strategy approach to investigate the impact of eco-innovation on business performance from the perspectives of differentiation and cost-leadership competitive advantages. It is even more important that few studies (Bıçakcıoğlu, 2018; Leonidou et al., 2013; 2015) investigated the effect of eco-innovation on competitive advantage in international markets and export performance. However, scientific discussion on whether or not eco-innovation implementation results in differentiation and cost-leadership competitive advantages is still inconclusive. Wang et al. (2020) confirmed that eco-innovation has a positive effect on differentiation competitive advantage by appealing to environmentally sensitive customers, and eco-innovation can directly improve the cost competitive advantage. On the other hand, Liao (2016) confirmed that eco-process innovation improves competitive advantages of both low cost and differentiation, whereas eco-product innovation only improves the differentiation advantage.

Therefore, this dissertation proposes a classification of four mutually exclusive and collectively exhaustive eco-innovation strategy types based on the reasoning provided in sub-chapter 1.2 on distinct types of eco-innovation and different types of benefits according to the types of eco-innovation (Fig. 1.2).

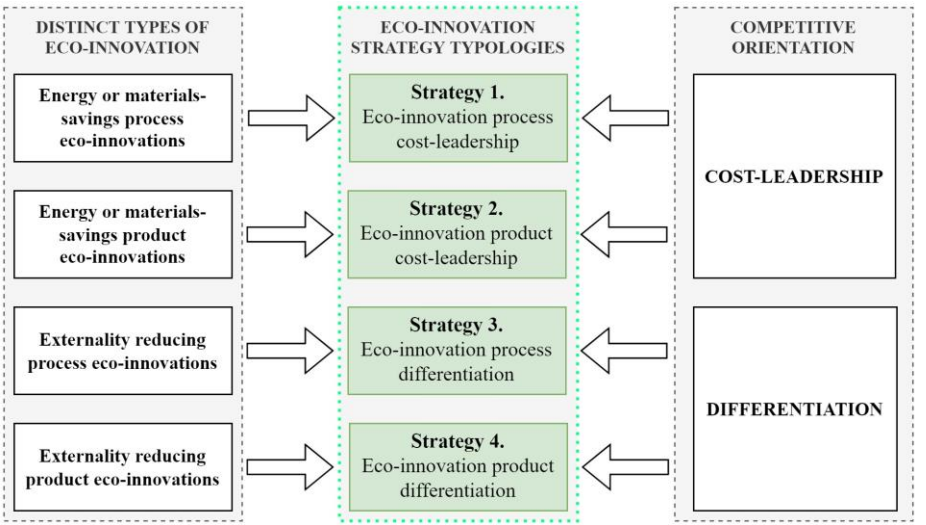


Fig. 1.2. Eco-innovation strategy typologies
(source: created by the author)

The concept of the outcome of an eco-innovation strategy requires including both economic improvement of the firm and the reduction of environmental impact (or delivery of environmental benefits) dimensions. This double objective approach is especially relevant for eco-innovation strategy and focuses either on operational cost and energy savings or differentiation of the firm. In addition, rapid globalization and rising competition on a global scale motivate companies to rearrange their operations internationally (Hojnik et al., 2018); therefore, the subsequent two sub-chapters are dedicated to a comprehensive conceptualization and in-depth explanation of the distinct types of eco-innovation strategy with a reflection on the international development.

1.3.1. Eco-Innovation Cost Leadership Strategies

Eco-innovation cost leadership strategy generates competitive advantage through superiority in resource efficiency, cost reduction, reuse of materials through recycling (Do & Nguyen, 2020; Molina-Azorín et al., 2015) and has positive effects on the firm's market and financial performance outcomes in export operations (Leonidou et al., 2015). According to Yurdakul and Kazan (2020), eco-innovation significantly reduces energy consumption and material costs, both in total and per unit, by improving product, process, and business methods. A firm's eco-innovation cost leadership strategy achieves savings in the organization of energy, water, and other important resources that, in turn, lead to reduced costs. In this context, pollution is seen as a sign of resource inefficiency (Molina-Azorín et al., 2015). The cost-leadership strategy aims to obtain and sustain a low-cost advantage over rivals by offering products in a particularly efficient way (Chen & Liu, 2018). Thus, the notion of eco-innovation cost leadership strategy implies the production and development of goods while simultaneously reducing environmental impact and the use of resources. According to Leonidou et al. (2015), such a strategy can also result in lower potential litigation expenses and reduced insurance fees in foreign markets. Cost reduction from eco-innovation can also come from having preferential access to cheaper raw materials, adopting recycling programs, and exploiting financially reprocessed by-products (Leonidou et al., 2015). Furthermore, cost-related advantages may also emerge from the achievement of economies of scale, resulting from the increasing acceptance of eco-friendly goods, particularly by the green consumer segment of foreign markets (Chen & Liu, 2018; Leonidou et al., 2015). Finally, eco-innovation cost leadership strategy in exporting businesses usually involves partnerships and collaborations with suppliers, sub-contractors, distributors, and other supply chain members, which can help streamline foreign activities and reduce costs (Leonidou et al., 2015).

This dissertation conceptualizes the two eco-innovation cost-leadership strategies as follows:

1. *The "eco-innovation process cost leadership strategy" is a strategic green transformation of company internal processes through the implementation of a set of energy eco-process innovations related to energy and/or material reduction and increasing efficiency of primary and supporting company operations.*
2. *The "eco-innovation product cost leadership strategy" is a strategic green transformation of company products through the implementation of a set of energy eco-product innovations related to energy and/or material reduction within the product, such as design, packaging, introduction of substitutes, etc.*

The results of empirical studies regarding the eco-innovation and cost leadership strategy effect on a firm's performance are mixed (Do & Nguyen, 2020). Molina-Azorín et al. (2015) investigated the hotel industry and confirmed that eco-innovation cost leadership strategy and a firm's orientation toward environmental management contribute to greater development of cost advantage, as it may help to reduce the use of energy, water and resources, and reduce other operational costs which are very important for hotels. Chen and Liu (2018) investigated firms in manufacturing sectors in China and found that cost-leadership strategy negatively moderates the relationship between eco-product innovation and firm performance and positively moderates the linkage between eco-process innovation and firm performance. Do and Nguyen (2020) investigated firms employing proactive environmental strategies in Vietnam and found that cost leadership strategy positively and significantly affects a firm's strategic performance (such as greater growth, higher market share, lower costs, etc.) but had no significant effect on product performance (i.e., higher quality, more added value, etc.), production performance (i.e., more efficient production systems, higher quality of production processes), and no effect on financial performance (i.e., better profit margins, better value for shareholders, more efficient cash flow). Leonidou et al. (2015) investigated exporting manufacturers in Greece, and similar results were obtained by Do and Nguyen (2020). Both studies confirmed that an environmentally friendly export business strategy did not affect the achievement of a cost leadership advantage position in export operations. Leonidou et al. (2015) provided the following reasoning: because some of the participating exporters merely adhered to the minimum environmental standards required by foreign countries, as opposed to reaping substantial cost advantages through the proactive embrace of eco-innovation practices. Additionally, a cost leadership strategy had no significant effect on export performance. According to Leonidou et al. (2015), firms grapple with the challenge of maintaining a long-term cost-based competitive edge, as exporting companies might opt for a compliance-oriented approach.

Despite the criticisms that eco-innovation may lead to unnecessary expense and unproductive investments, the cost savings associated with such an approach can result in better prices that will satisfy existing customers and attract new ones in foreign markets (Leonidou et al., 2015). Providing offerings in the foreign market comparable to the competitors and with lower costs, the firm can set better prices that help retain existing customers, gain new customers, and even expand the number of customers (Leonidou et al., 2015). Furthermore, a low-cost leadership advantage can improve sales, profits, and other financial performance indicators related to the firm's export activities (Leonidou et al., 2015). Therefore, the mixed results might make it difficult for managers to decide whether to pursue the eco-innovation cost leadership strategy. Such a strategy might require high investments and costs involved in transforming the organization to conform to environmental concerns in foreign markets, which usually takes time to yield satisfactory returns (Leonidou et al., 2015).

However, several studies confirmed that in the short term, if firms consider environmental expenditures as cost (usually to meet minimum environmental standards as determined by laws), they might not achieve a competitive advantage. However, if firms consider environmental expenditures as an investment in the long term, they can create value for owners, customers, and other stakeholders (Do & Nguyen, 2020; Leonidou et al., 2015). These findings lead to the conclusion that a firm's environmental orientation and strategic decision to implement an eco-innovation strategy is a long-term issue, and it takes time between making eco-innovation investments and receiving financial returns. On the contrary, the differentiation through eco-innovation is a more studied phenomenon in the scientific literature.

1.3.2. Eco-innovation Differentiation Strategies

The eco-innovation differentiation strategy generates a competitive advantage through the distinctive organization's green image/brand position and environmental reputation, compared to competitors (Chen & Liu, 2018; Chen et al., 2012; Do & Nguyen, 2020; Molina-Azorín et al., 2015). Such green differentiation can signal that the company is a good "corporate citizen" in the foreign market, acting in a socially responsible manner (Leonidou et al., 2015). Higher eco-innovation commitment strategy might promote firms' distinctive images, higher product quality, and better customer value, compared to those of rivals (Do & Nguyen, 2020; Molina-Azorín et al., 2015) and can improve customer satisfaction, encourage repeat purchase of goods, and attract new buyers in international markets (Leonidou et al., 2015). By "going green" companies target environmentally sensitive consumers, whose purchase decisions are influenced by the product's or

company's environmental features and responsibilities (Molina-Azorín et al., 2015). Adding extra green dimensions to the product (e.g., recyclable packaging, biodegradable construction, toxic-free materials) can help the firm build a more distinctive picture in the eyes of foreign buyers than competing brands (Leonidou et al., 2015). Differentiation advantage, stemming from the environmentally friendly export business approach, can be achieved through the provision of innovative products to the foreign market and significant improvements in tangible (e.g., economical operation) or intangible (e.g., sense of safety) aspects of the firm's products (Leonidou et al., 2015). The eco-innovation strategy can be associated with positive quality connotations (attributed, e.g., to the use of superior raw materials, specialized production processes, and stringent quality control systems), which can help improve differentiation over rival firms (Leonidou et al., 2015). Moreover, the firms pursuing an eco-innovation strategy often obtain environmental certificates, eco-labels or green awards, such as ISO14001, which help these firms differentiate themselves in local (Do & Nguyen, 2020) and foreign markets (Leonidou et al., 2015), increase their competitiveness and brand awareness, acquire customer recognition, and support product differentiation (Ma et al., 2019). Consequently, an eco-innovation differentiation strategy can yield strong foreign market and export financial performance, including higher sales and profit (Leonidou et al., 2015).

This dissertation conceptualizes the two eco-innovation differentiation strategies as follows:

1. *The "eco-innovation process differentiation strategy" is a strategic green transformation of company internal processes through the implementation of a set of environmental eco-process innovations related to the reduction of externality and brand image differentiation through environmental certificates, eco-labels, green awards, etc.*
2. *The "eco-innovation product differentiation strategy" is a strategic green transformation of company products through the implementation of a set of environmental eco-product innovations related to the reduction of externality by adding additional environmental dimensions to the product, such as recyclable packaging, biodegradable construction, toxic-free materials, etc.*

The results of empirical studies regarding the effect of eco-innovation and differentiation strategy on a firm's performance are different from the cost leadership strategy. Few studies found a significant and positive effect of eco-innovation differentiation strategy on a firm's performance (Do & Nguyen, 2020; Leonidou et al., 2015; Molina-Azorín et al., 2015). Do and Nguyen (2020) revealed that an eco-innovation differentiation strategy stimulated firms to retain customers, achieve new green-sensitive consumers, enhance long-term growth and reach

higher market share, profit margin and shareholder value. Leonidou et al. (2015) disclosed that a firm's product differentiation advantage, which is built on green dimensions, positively affects both export market performance and export financial performance. Adopting an ecological business approach to export markets helps differentiate tangible and/or intangible aspects of the firm's offering and gives it a distinct place in foreign customers' minds (Leonidou et al., 2015). Such an ecological differentiation helps the firms cultivate a distinct positioning in the foreign market, attracting and retaining customers and achieving greater sales and profits (Leonidou et al., 2015).

Finally, Chen and Liu (2018) found that eco-innovation differentiation strategy positively moderated the relationship between eco-product innovation and firm performance but negatively moderated the relationship between eco-process innovation and firm performance. As a result, a differentiation strategy will shape the performance implications for different green innovation types differently. According to Chen and Liu (2018), eco-product innovation can effectively promote customer loyalty, entering new market segments, expanding their product portfolio, acquiring higher premium benefits, and rendering the firm's product unique as compared to competitors, which results in greater economic benefits. However, eco-product innovation induces higher costs of inputs and reduces the firm's profitability. Chen and Liu (2018) argued that higher sales can compensate for increased costs because consumers are more likely to purchase a firm's green product at a higher price premium when the firm successfully communicates. On the other hand, Chen and Liu (2018) argued that eco-process innovation may generate resource tensions that undermine firm performance. Chen and Liu (2018) argued that as competitive intensity increases, the effect of this moderation on eco-innovation and firm performance becomes stronger. Thus, the competitive strategy is critical for the performance implications of eco-innovation, especially when competition is intense. Competitive strategy can influence a firm's performance through a value-capturing role in capitalizing on and profiting from eco-innovation (Chen & Liu, 2018). In addition, Chen and Liu (2018) highlighted value capturing from eco-innovation and emphasized the importance of matching eco-innovation with business strategy in gaining competitiveness in the market.

However, differentiation through eco-innovation requires some caution. First, environmental differentiation is obtained at the cost of good corporate economic results because the firm's resources are devoted to reducing environmental impacts, preventing the firm from allocating them to alternative investment projects or simply returning them to shareholders (Molina-Azorín et al., 2015). Today, firms are searching for many more opportunities to differentiate themselves from the competition through eco-innovation activities to acquire a competitive advantage (Cai & Li, 2018). However, if the firm operates in a highly competitive

market, which depends on environmental development, the differentiation through the environmental dimension might be a challenge due to competitors' similar actions. Therefore, a firm's decision to differentiate through eco-innovation might depend on whether the firm seeks a first-mover advantage (Przychodzen et al., 2020). As stated before, differentiation through eco-innovation generates a competitive advantage that distinguishes a firm from rivalry and is inseparable from higher costs and reduced profitability in the short term. Kiefer et al. (2019) stated that short-term-oriented businesses may focus on efficiency-related innovative activities. Notably, increased costs can be compensated by increased sales, impacted by successful communication to the customers who are tended to by green products at a higher price premium.

Consequently, the strategic decision regarding the selection of an eco-innovation strategy is a multifaceted process encompassing a multitude of interrelated factors at different levels. Nevertheless, the ever-evolving global landscape and the intensifying competition in international markets force companies not to question the worthiness of an eco-innovation strategy but rather to decide "which" eco-innovation strategy is the most optimal and best aligns with the overall internationalization strategy of the company.

1.4. Strategic Decision-Making Perspective on Eco-Innovation Strategy in the Context of Internationalization

Internationalization is not a new phenomenon compared to eco-innovation. As a research topic, internationalization has been developing for more than 60 years (Głodowska et al., 2019). In general, internationalization is a process in which firms gradually increase their international involvement (Johanson & Vahlne, 1977) or a process of increasing commitments to foreign markets (Dominguez & Mayrhofer, 2017). Onkelinx et al. (2016) refer to internationalization as a firm's foreign market service strategy. Demeke and Chiloane-Tsoka (2015), in addition to export activities, included trade, cross-border clustering, collaboration, alliances, subsidiaries, branches, and joint ventures that extend beyond the environment of the home country. Throughout the years, the concept of internationalization has undergone analyses from the perspective of various scientific disciplines, employing various theoretical concepts and empirical models, and one of the most frequently discussed topics refers to the internationalization strategy (or international strategy) (Głodowska et al., 2019). Głodowska et al. (2019) defined internationalization strategy as an integral component of a firm's overall strategic framework, encompassing its interactions and relationships with foreign countries.

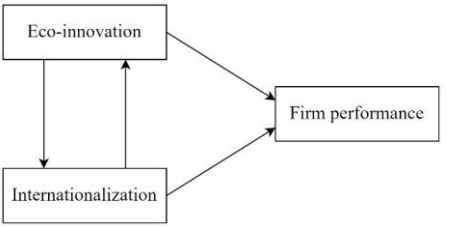


Fig. 1.3. Relationships of eco-innovation, internationalization and firm performance (source: created by the author, according to Chai, 2022; Chen, 2022; Hojnik et al., 2018; Juniati et al., 2019; Martínez-Ros & Merino, 2023; Šūmakaris et al., 2020)

However, in the scientific literature, there is a growing focus on the relationships between internationalization and eco-innovation, but to date, very little is known about the interrelationships among the two (Galbreath et al., 2021; Martínez-Ros & Merino, 2023). Therefore, to underpin the theoretical approach of strategic decision-making perspective on eco-innovation strategy in the context of internationalization, first, it is essential to comprehend the relationships between the two. Two scientific approaches can be distinguished when investigating the relationships between eco-innovation, internationalization, and firm performance (Fig. 1.3).

First, internationalization is considered a driver of eco-innovation that provides the knowledge and opportunities for successful eco-innovation development. This approach is considered "learning by exporting" (Hanley & Semrau, 2022), in which exporters learn from foreign customers and partners by implementing new production technologies and subsequently eco-innovate. Companies have to respond to the changes in demand and lifestyles of foreign consumers, therefore introducing eco-innovation (Bossle et al., 2016). Therefore, internationalization is considered a driving force for companies to learn and implement eco-innovations (Juniati et al. 2019). Companies gain information on regulatory demands and foreign customer needs and improve their understanding of foreign markets, partners, competitors, and technological gaps (Hojnik et al., 2018). Arranz et al. (2019) observed that firms with a higher degree of internationalization pursued eco-innovation objectives more frequently. Chen (2022) found that when the internationalization of the firm is low, it has a significant negative effect on the performance of eco-innovation.

Second, empirical evidence supports the positive impact of eco-innovation on internationalization, which can also mediate the relationships with firm performance (Hojnik et al., 2018; Juniati et al., 2019; Martínez-Ros & Merino, 2023). The implementation of eco-innovation enables internationalization and companies' adaptation to the global competitive environments (Hojnik & Ruzzier, 2017). For

instance, Leonidou et al. (2015) found that the eco-innovation product differentiation strategy was positively associated with both export market performance and export financial performance. Martínez-Román et al. (2019) disclosed that product innovation impacted the firm's commercial expansion and export activity. Both studies by Juniati et al. (2019) and Hojnik et al. (2018) found that internationalization had a direct and significant impact on firm performance but also an indirect, mediated effect, through the adoption of eco-innovation. Chai (2022) found that the implementation of eco-innovation demonstrated a positive effect on export quality. Furthermore, Lodi and Bertarelli (2022) found a positive effect of eco-innovation on the propensity to export and argued that Eastern European firms, which are not able to bear the higher compliance costs by implementing eco-innovation, are less efficient and consequently less likely to be exporters. Finally, Martínez-Ros and Merino (2023) found that eco-innovation provides an extra capability that enhances the probability of entering new international markets and that its effects are long-term. To sum up, eco-innovation plays an overwhelming role in internationalization and is considered a driver (direct or mediator) of internationalization, which improves the international performance of the firm and opens new market opportunities (Hojnik et al., 2017; Urbaniec & Tomala, 2021). Therefore, this dissertation adopts the second approach, and the eco-innovation strategy is considered an integral component of the internationalization strategy.

However, the scientific domain has been neglecting the concept of eco-innovation strategy in the development of internationalization. Previous studies have failed to address and investigate eco-innovation from the strategic perspective and the strategic decision-making perspective of the firm's internationalization strategy. However, strategic decision-making has emerged as one of the most active areas of management research (Papadakis et al., 1998) and is central to organizational actions and long-term competitiveness (Calabretta et al., 2017). Therefore, to ground the application of the strategic decision-making perspective for eco-innovation strategies in the context of internationalization, fundamental strategic decision-making approaches and models are integrated as follows. First, this dissertation adopts the classic model of strategic management presented by David (2007). Namely, it comprises three stages: (1) strategy formulation, also known as strategic planning, which involves (i) developing vision and mission statements, (ii) assessing internal and external environments, (iii) establishing long-term goals and objectives, (iv) alternative generation, evaluation, and selection; (2) strategy implementation, involving such activities as establishing annual objectives, devising policies for each business function, allocating resources, etc.; and (3) strategy evaluation, which is aimed at changing or taking corrective actions in the strategy and measuring and evaluating performance.

Furthermore, the core of strategic management is the strategic decision-making process, which is a highly complex process of resource arrangement and configuration linked to firm-specific advantages and improved performance (Petrou et al., 2020). Strategic decisions can be ill-structured, non-routine, uncertain and pervasive and cut across organizational functions, entail a significant financial outlay, and have profound, long-term implications for the organization (Shepherd & Rudd, 2014). The management literature offers three distinct approaches to the strategic decision-making process (Calabretta et al., 2017; Flores-Garcia et al., 2021): (1) normative decision-making, (2) intuitive decision-making, and (3) mixed decision-making.

First, normative (or rational) decision-making involves a logical step-by-step analysis involving a quantitative assessment and requires information that is clear, objective, and well-defined (Flores-Garcia et al., 2021). When rationality refers to "the reason for doing something, and to judge a behavior as reasonable is to be able to say that the behavior is understandable within a given frame of reference" (Elbanna & Child, 2007). It is a step-by-step decision-making process that includes identifying and formulating the problem, thoroughly assessing information, generating a set of alternatives, evaluating the costs and benefits of these alternatives, and ultimately making a logical choice based on conscious deliberation (Calabretta et al., 2017). However, this decision-making process can be slow and conscious, where information is logically decomposed and sequentially recombined to generate an output (Papadakis et al., 1998). Thus, it is not always appropriate to deal with the time pressure, complexity, and uncertainty of innovation decision-making (Calabretta et al., 2017). Another limitation of such an approach suggests that decision-makers are intended to be rational, but the rationality is limited; for instance, individuals may systematically deviate from recommendations produced by decision models (Flores-Garcia et al., 2021). Despite the drawbacks, normative decision-making continues to be used by organizations and has frequently led to good outcomes (Flores-Garcia et al., 2021). Based on a rational decision-making approach for complex decisions in business organizations, Simon (1955, 1960, 1978) presented a decision-making model consisting of four stages: (1) information collection – the initial stage: definition of a problem, main purposes, source information collection, comparison of the real situation and expected changes; (2) decision modeling – analysis of obtained information, problem modeling, selection of criteria, alternatives and decision methods; (3) decision-making – implementation of experiments and researches, evaluation of results, choice of the best alternative; (4) decision implementation – informing implementers about the decision, examination if the best alternative was chosen, implementation of decision and assessment of the results.

Second, intuitive decision-making involves affectively charged judgments that arise through the rapid, nonconscious, holistic association of information (Flores-

Garcia et al., 2021). Such an approach is associated with having a strong hunch or feeling of knowing what is going to occur and can be advantageous when professionals are confronted with time pressure and possess experience in a field (Flores-Garcia et al., 2021). Thus, similarly to rational information processing, the intuitive process includes problem definition, analysis, and synthesis, but these stages occur faster and are mostly nonconscious and deeply intertwined (Calabretta et al., 2017). Such an approach can be used in making operational and everyday decisions; however, when it comes to complex strategic decisions, such as eco-innovation and internationalization, it might not be the best approach. According to Shepherd and Rudd (2014), such complex strategic decisions include too many contextual variables, such as the firm's internal environment (capabilities, structure, resources, etc.), the firm's external environments (uncertainty, dynamism, munificence, hostility, instability, etc.), specific decision makers' characteristics (demographics, psychological and personal characteristics, etc.), strategic-decision-specific characteristics (time pressure, importance, motive, etc.).

However, according to Calabretta et al. (2017), there is widespread acceptance in the scientific community that strategic decision-making requires both intuition and rationality in the decision-making process. Therefore, the third alternative includes the use of mixed decision-making approaches, where the main strength of this approach lies in reducing personal bias and allowing the comparison of dissimilar alternatives while integrating quantitative analysis (Flores-Garcia et al., 2021). Such an approach provides solutions to problems involving conflicting objectives or criteria affected by uncertainty (Kahraman et al., 2015). Flores-Garcia et al. (2021) argued that literature presents a variety of alternatives concerning mixed decision-making approaches, yet these have the common objective of helping deal with the evaluation, selection and prioritization of problems by imposing a disciplined methodology. Therefore, based on the strengths stated above, this dissertation adopts a mixed decision-decision approach as a foundation to propose the decision support framework.

Throughout the time, based on a mixed decision-making approach, various measures, such as decision support frameworks (or tools, systems), were developed to help decision-makers make better strategic decisions and improve business performance, create added value and overcome obstacles (Yan, 2018). Decision support frameworks aim to assist decision-makers in making complex strategic decisions and help to compile useful information from a combination of raw data, documents, and personal knowledge. For complex decisions, Multi-Criteria Decision-Making (MCDM) is a generic term used for a collection of systematic approaches developed specifically to support the systematic evaluation of alternatives in terms of multiple and often conflicting objectives (Kahraman et al., 2015). MCDM refers to making decisions in the presence of multiple and usually conflicting criteria (Kahraman et al., 2015). The multi-criteria decision process consists of

the following steps (Pohekar & Ramachandran, 2004): (1) formulation of the alternatives, (2) selection of the criteria, (3) selection of decision process, (4) performance evaluation, (5) decision on the parameters, (6) application of the method, (7) evaluation of the results, and (8) selection of the best alternative. Moreover, MCDM provides not only a framework for making strategic decisions but, most importantly, a framework for thinking and talking about a decision (Montibeller & Franco, 2011).

In essence, when companies pursuing international competitive advantage encounter a multitude of challenges, and, in the process, a wide number of complex strategic decisions must be made, and various strategies have to be integrated. One of the main complex strategic decision problems arises from the trade-off between economic and environmental dimensions in the process of internationalization. Given that this perspective necessitates the integration of both eco-innovation and internationalization strategies, the subsequent sub-chapters are dedicated to shedding light on when the eco-innovation strategy comes into consideration and integrates with the overall firm's internationalization strategy and the factors that influence the selection of eco-innovation strategies.

1.4.1. Eco-innovation Strategy Decision-Making in Pre-Internationalization Phase

The strategic approach of the business company when entering a new international market is closely related to the strategy that is maintained when operating in a foreign market. In other words, the company's foreign market entry encompasses not just the initial strategic actions taken at the beginning of operations in a new market but also outlines the strategic approach that the company intends to adopt for its operations within that market in the future (Ďaďo et al., 2015). Therefore, with a worldwide growing importance for the environmental responsibility of business companies, in this dissertation, a particular focus is put on the pre-internationalization phase (i.e., before export) of business companies and the strategic decision-making process related to eco-innovation to gain competitive advantage in new international markets. Moreover, Martínez-Ros and Merino (2023) recently concluded that eco-innovation provides an extra capability that enhances the probability of not only entering new international markets but also remaining exporters in the long term.

To underpin the strategic decision-making related to the eco-innovation strategy in the pre-internationalization, it is important to first reflect on the company's internationalization process and the strategic decisions the company encounters in the process. Although extensive research has been conducted on the internationalization process, the company's behavior, decision-making, and strategies employed prior to internationalization have not received enough attention (Haddoud

et al., 2021; Tan et al., 2007). As such, an opportunity exists for a more in-depth exploration and analysis of this critical phase in a firm's internationalization development.

The firm's pre-internationalization phase (Fig. 1.4) can be established as a state that all firms experience before their initial commitment to a foreign market (Tan et al., 2007, 2018). When the company is in the pre-internationalization phase and is considering the decision to internationalize, that state is described as ready to export, or "internationalization readiness (IR)", which is a concept that describes the potential transition of the company from a purely domestic to an international (Tan et al., 2007). In the pre-internationalization phase, the extent of export readiness determines export success or failure (Gerschewski et al., 2020). Tan et al. (2007) developed an Internationalization Readiness Index by building on the Uppsala-based pre-internationalization model and defined IR as a "firm's preparedness and propensity to commence internationalization". The index is developed with the intent to improve understanding of the internationalization process, and in particular, the pre-internationalization phase, and to point to possible strengths and weaknesses of firms preparing for that step, rather than a normative tool for decision making (Tan et al., 2007)).

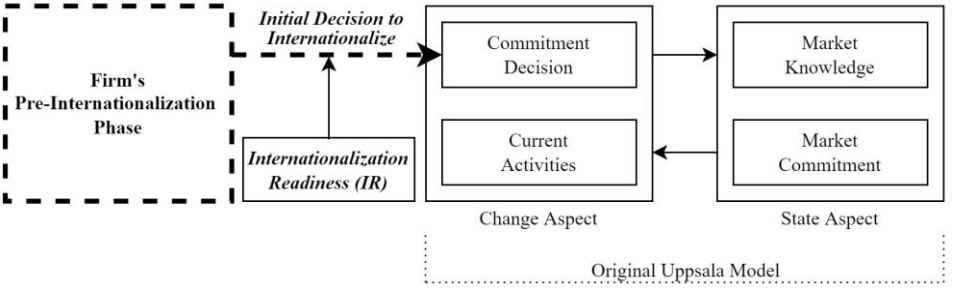


Fig. 1.4. Firm's per-internationalization phase and internationalization readiness (source: modified according to Tan et al., 2007, 2018)

When the firm initiates its first export, it exits the pre-internationalization phase and enters the internationalization process as described by the Uppsala Model as a state-to-change aspect transition (Tan et al., 2007). The Uppsala model (Johanson & Vahlne, 1977; 2009) states that internationalization is the gradual process of acquiring, integrating, and utilizing knowledge and competence in international operations through increased participation in international markets (Johanson & Vahlne, 1977). Thus, market commitment is managed through a stepwise increase in the firm's experiential knowledge and network relationships (Johanson & Vahlne, 1977; 2009). Subsequently, to assess the degree of internationalization, most studies rely on measuring (a) export performance, i.e., the share of sales

abroad to total sales, or (b) the number of foreign markets in which the company operates (Galbreath et al., 2021; Hojnik et al., 2018).

However, if the company decides not to export, it remains within the pre-internationalization phase (Tan et al., 2007). A firm's pre-internationalization behavior is defined as the activities in the period until the firm realizes its first export sale (Gerschewski et al., 2020). In this period, a wide range of complex strategic decisions must be made before the company starts exporting. Morais and Ferreira (2020) stated that a company faces the initial decision of internationalization followed by two strategic decisions: (1) market selection and (2) entry mode/strategy selection (Morais & Ferreira, 2020). Similarly, the REM model originally developed by Liuhto (2002) (Fig. 1.5), is designed as a simplistic tool for the analysis of internationalization at the company level, which conceptualizes three major strategic decisions in the internationalization process: (1) the "R-factor" is the foundation of the REM model and it is related to the reasons for internationalization (why to internationalize?), (2) the "E-factor" is related to environment selection (where to internationalize?), and (3) the "M-factor" is related to modal choice (how to internationalize?).

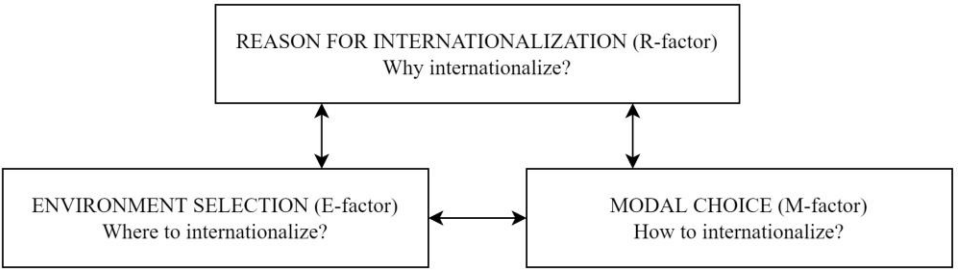


Fig. 1.5. REM model (source: modified, according to Liuhto, 2002)

However, each of the three major strategic decisions is affected by a multiplicity of contextual factors. Based on (Morais & Ferreira, 2020) insights on the phenomenon, REM model (Liuhto, 2002), foreign market selection (Korsakienė & Tvaronavičienė, 2012; Morais & Ferreira, 2020; Vanegas-López et al., 2021), and foreign market entry strategy classification (Ďaďo et al., 2015; Kraus et al., 2017; Morais & Ferreira, 2020), Figure 1.6 presents the three major strategic decisions in the pre-internationalization phase.

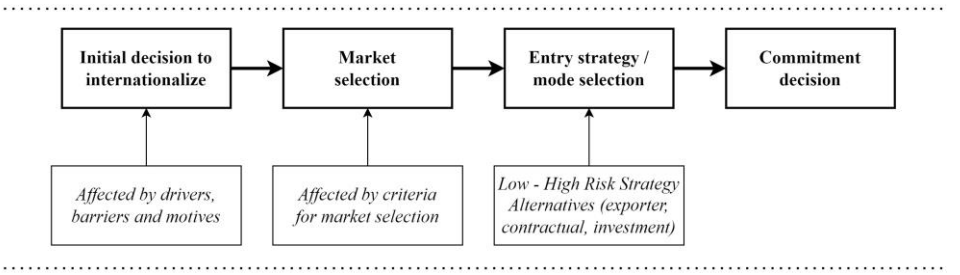


Fig. 1.6. Major strategic decisions in the pre-internationalization phase (source: modified, according to Ďaďo et al., 2015; Korsakienė & Tvaronavičienė, 2012; Kraus et al., 2017; Liuhto, 2002; Morais & Ferreira, 2020)

First, central to all decisions in the process is the initial decision to internationalize. During the pre-internationalization phase, a firm is exposed to various stimuli that may trigger an impulse for foreign market expansion (Tan et al., 2007). Hence, various internal and external factors affect a firm's readiness to initiate the decision to internationalize (Tan et al., 2007). In the scientific literature, internationalization drivers are often classified as internal and external, as well as reactive and proactive (Ďaďo et al., 2015; Gerschewski et al., 2020; Morais & Ferreira, 2020). Korsakienė and Tvaronavičienė (2012) determined motives and barriers for internationalization, where motives are small domestic market, competitive pressure, profit goals, availability of skilled labor, etc., and barriers are inaccessible market information, limited financial resources, limited management skills, lack of marketing knowledge, etc. Ďaďo et al. (2015) categorized three major reasons for undertaking internationalization: (1) market-related motives, such as the size of the foreign market, enquiry tenders or foreign orders, etc., (2) economic motives, such as the possibility of increased production capacity or more effective use of domestic production potential, the possibility of achieving higher profitability ratios, etc., and (3) legal motives, such as favorable regulations in foreign market; and support offered to overseas operations by domestic institutions.

Second, Morais and Ferreira (2020) stated that market selection is determined by geographic proximity and knowledge/experience of the market by the chief executive officer (CEO), its dimension and level of attractiveness, but essentially, due to the existence of social and business relationships with partners in these countries. Korsakienė and Tvaronavičienė (2012) determined the main criteria for market selection as follows: (1) geographic proximity, (2) potential growth of markets, (3) formal relationships with industry's partners, (4) accumulated knowledge and varied experience of the entrepreneur, (5) informal relationships with family members and friends, (6) ability of the entrepreneur to gain support

and mobilize resources. Vanegas-López et al. (2021) applied a hybrid multi-criteria decision-making technique for international market selection and categorized the main factors: (1) costs, (2) trade barriers, (3) logistics, (4) cultural environment, and (5) economics (see Vanegas-López et al., 2021 for more detailed information on sub-factors).

Third, the foreign market entry mode, usually referred to as "pathways" or "patterns", "entry strategy" or "entry form" of internationalization in the scientific literature (Ďaďo et al., 2015; Morais & Ferreira, 2020), is another major strategic decision in the process. Firms can choose from various entry modes, which can be clustered by their degree of resource commitment and the risk involved (Kraus et al., 2017). Foreign market entry strategies can be distinguished into three groups of strategies (Ďaďo et al., 2015): export, contractual, and associated with full commitment to capital. Export is the market entry mode with the lowest risk compared to other internationalization strategies and involves lower levels of resource commitment than other internationalization strategies (Kraus et al., 2017), and around 57% of SMEs adopt a gradual approach to internationalization (Morais & Ferreira, 2020). Entry strategies, such as contract-based agreements, e.g., licensing, franchising or strategic alliances (partnerships between two or more independent organizations), are moderately risky for the organization, and foreign direct investment strategies, such as joint ventures, minority stakes, and fully owned subsidiaries, involve the highest risk to the organization and require the most resources (Kraus et al., 2017). However, the traditional internationalization pattern, commonly structured into phases, involves a gradual increase in foreign market commitment through export (Johanson & Vahlne, 1977; 2009), and exporting is the most common entry strategy (Kraus et al., 2017; Morais & Ferreira, 2020). However, the choice of an entry strategy depends on the market selection and vice versa (Liuhto, 2002).

Consequently, with the importance of eco-innovation strategy and the worldwide growing importance of environmental issues and the consequences of economic development on the environment, this dissertation posits an assertion that within the stream of strategic decisions in the pre-internationalization phase, it is important to consider the eco-innovation strategy in the pre-internationalization phase as an integral strategy of the broader framework of internationalization strategy. Therefore, based on Kitsios et al. (2020) provided the conceptual framework for sustainable strategies integration, to substantiate the theoretical framework surrounding eco-innovation strategies in the context of international expansion, this dissertation views eco-innovation strategies as an integral strategy of a company's internationalization strategy, and the decision related to eco-innovation strategy selection must be made in the pre-internationalization phase (Fig. 1.7).

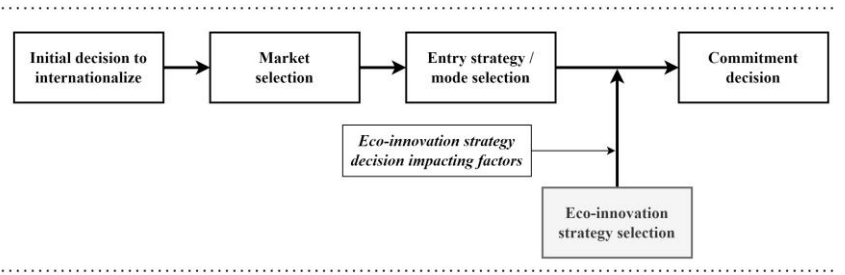


Fig. 1.7. Eco-innovation strategy integration within the stream of strategic decisions in the pre-internationalization phase (source: created by author)

To sum up, the strategic decisions made in the pre-internationalization phase will shape the company's subsequent international development process and its growth opportunities in international markets. From a comprehensive approach to strategic planning, the eco-innovation strategy is regarded as an integral strategy of a business internationalization strategy and seeks to create a unified and coherent strategy aimed at attaining a competitive advantage in international markets. However, the proposed novel classification of eco-innovation strategies requires a more in-depth exploration of the factors that affect the selection of the eco-innovation strategy.

1.4.2. Eco-Innovation Strategy Decision Impacting Factors

The concept of eco-innovation strategy in the development of internationalization is a fairly new phenomenon and has so far been neglected in the scientific literature. As a consequence, little to no research has been done to classify the eco-innovation strategy decision-impacting factors. It is safe to say that there are no studies on eco-innovation strategy decision-impacting factors in the development of internationalization. However, the field of eco-innovation is very crowded with studies that investigate the drivers of eco-innovation. For example, multiple empirical studies, meta-analytic studies, and systematic literature reviews have been conducted to disclose the drivers of eco-innovation in manufacturing SMEs (Pacheco et al., 2017), drivers for eco-innovation adoption (Bossle et al., 2016), from a firm-level knowledge-based resource view perspective (Pham et al., 2019), to identify the main clusters of drivers of eco-innovation (Zubeltzu-Jaka et al., 2018), from firms internal capabilities perspective (Salim et al., 2019), etc.

Arguably, factors driving eco-innovation differ from factors that are considered in the strategic decision-making process; thus, different factors are at play when firms are driven to implement eco-innovations compared to factors that are being evaluated in the decision-making process. Jové-Llopis and Segarra-Blasco (2018) stated that a theory of innovation, which includes push and pull factors as

the main drivers of eco-innovation, is not comprehensive enough when it comes to the decision to implement an eco-innovation strategy. Therefore, it is important to distinguish the driving factors that push or pull toward eco-innovations from the factors that are essential to evaluate in the eco-innovation strategy selection process.

Based on the systematic literature review and qualitative content analysis methodology presented by Šūmakaris et al. (2021) in this dissertation, the eco-innovation strategy decision-impacting factors in the development of internationalization are identified and analyzed. This dissertation adopts a multilevel framework similar to previous studies (Bossle et al., 2016; Díaz-García et al., 2015) and classifies the eco-innovation strategy decision-impacting factors into the following: (1) micro-level environment (resources and capabilities (A)); (2) meso-level environment (foreign market dynamics (B)); and (3) macro-level environment (environmental regulation and taxes (C) and public financial support (D)). A summary of eco-innovation strategy decision-impacting factors is presented (Table 1.4). For a detailed description of each factor and sub-factor, see Šūmakaris et al. (2023).

Table 1.4. Summary of factors and sub-factors impacting the selection of eco-innovation strategy (source: created by the author)

Level	Factor (label)	Sub-factor (label)	Author(s), Year
Micro-level environment	Resources and capabilities (A)	Employee pressure (A1)	Chan et al., 2014; Kim et al., 2016; Weng et al., 2015
		Managerial environmental concern (A2)	Eiadat et al., 2008; Hojnik & Ruzzier, 2016; Leonidou et al., 2015; Wang, et al., 2019
		Financial resources (A3)	Ghisetti et al., 2017; Lin et al., 2014; Marín-Vinuesa et al., 2020
		Environmental absorptive capacity (A4)	Aboelmaged & Hashem, 2019; Albort-Morant et al., 2018; Chen et al., 2015; Solnørdal & Thyholdt, 2019
		Environmental dynamic capabilities (A5)	Chen et al., 2015; Dangelico et al., 2017; Lin & Chen, 2017; Yousaf, 2021
Meso-level environment	Market dynamics (B)	Customers' demand for environmental products (B1)	Kammerer, 2009; Y. Li, 2014; Melander, 2017
		Customers' demand for environmental production processes (B2)	Cai & Li, 2018; Hojnik & Ruzzier, 2016; Yu et al., 2017
		Competitive intensity (B3)	Cai & Li, 2018; Hojnik & Ruzzier, 2016; Leonidou et al., 2015; Li, 2014; Weng et al., 2015
		Supplier pressure (B4)	Chiou et al., 2011; Hofman et al., 2020; Wu, 2013

End of Table 1.4

Level	Factor (label)	Sub-factor (label)	Author(s), Year
		Social pressure (B5)	Garrone et al., 2018; Leonidou et al., 2015; Wang, et al., 2019
		Environmental innovativeness within the industry (B6)	Berrone et al., 2013; Kruse & Wetzel, 2016; Sadovnikova & Pujari, 2017
Macro-level environment	Regulation and taxes (C)	Existing environmental regulations (C1)	Caravella & Crespi, 2020; Garrone et al., 2018; Jové-Llopis & Segarra-Blasco, 2018; Stucki et al., 2018; Weng et al., 2015
		Existing environmental taxes, charges or fees (C2)	Caravella & Crespi, 2020; García-Quevedo & Jové-Llopis, 2021; Stucki et al., 2018
		Environmental regulations or taxes expected in the future (C3)	Liao & Tsai, 2019; Moreno-Mondéjar & Cuerva, 2020; Segarra-Blasco & Jové-Llopis, 2019
	Public financial support (D)	Financial support from local authorities (D1)	Arranz et al., 2019; Nieves Arranz et al., 2021; Jové-Llopis & Segarra-Blasco, 2018
		Financial support from the national government (D2)	Arranz et al., 2019; Nieves Arranz et al., 2021; Caravella & Crespi, 2020; Jové-Llopis & Segarra-Blasco, 2018
		Financial support from Horizon Europe (D3)	CIS 2020
		Financial support from the European Union (D4)	Arranz et al., 2019; Nieves Arranz et al., 2021; Jové-Llopis & Segarra-Blasco, 2018

The selection of an eco-innovation strategy is a complex process that involves various multilevel aspects and the importance of selecting the best eco-innovation strategy in the context of internationalization compared to the strategic decision "if" the eco-innovation strategy is the best strategy for competitive advantage in international markets comes into play. Arguably, the set of factors (Table 1.4) is considered from the perspective of entering a new foreign market, compared to the eco-innovation strategy for existing markets, due to the fact that different factors are at play, such as the company's current green brand value and green image (Lin et al., 2021), environmental branding tactics and opportunities (Sarkar et al., 2021), and how green existing stakeholders perceive the company.

1.5. Framework for the Selection of Eco-Innovation Strategy in the Pre-Internationalization Phase

The literature review conducted in the first chapter disclosed a lack of a decision-support framework related to eco-innovation strategies in the context of the internationalization of the firm; therefore, further empirical research is needed. Figure 1.8

presents a theoretical framework for the selection of an eco-innovation strategy in the pre-internationalization phase and the field of scientific research area of this dissertation.

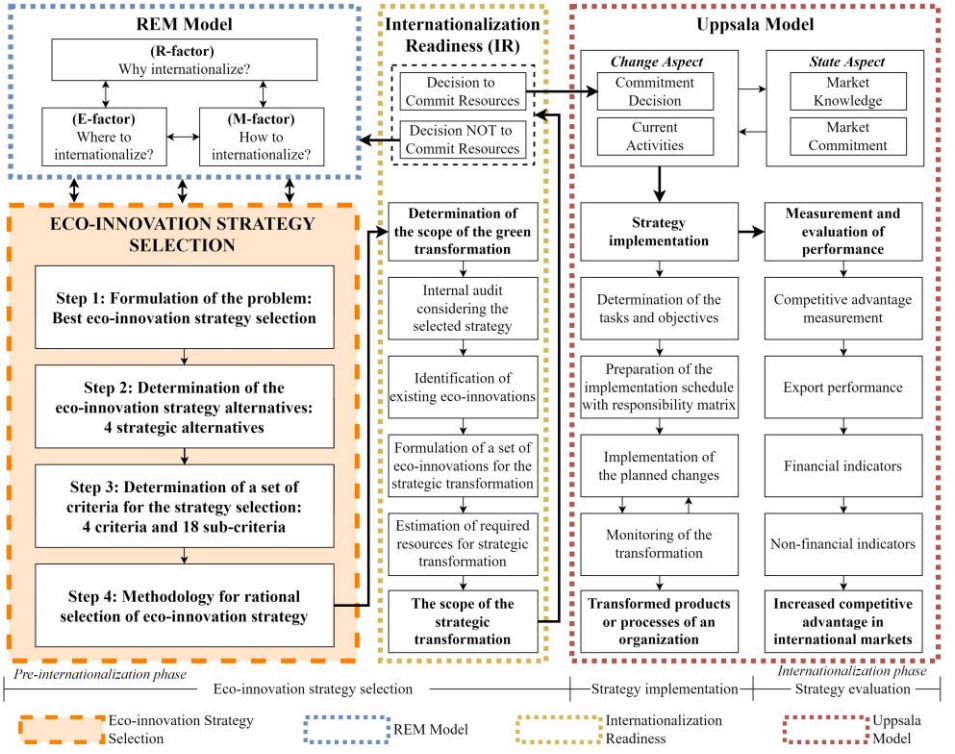


Fig. 1.8. Theoretical framework for the selection of eco-innovation strategy in the pre-internationalization phase (source: created by the author)

A theoretical framework is constructed based on the fundamental theories, concepts, and models as follows. The perspective of the classic strategy management process emphasizing the strategy evaluation and selection step (David, 2007), strategic decision-making process and influencing firm's and environmental contextual factors (Elbanna et al., 2020), mixed decision-making approach along with MCDM methods (Flores-Garcia et al., 2021; Kahraman et al., 2015), inclusion of the following internationalization models and concepts: (i) the REM model (Liuhto, 2002), (i) the internationalization readiness concept (Tan et al., 2007), and (iii) the Uppsala model (Johanson & Vahlne, 1977; 2009) and the novel classification of eco-innovation strategy alternatives and eco-innovation strategy decision impacting factors.

Since neither a universally superior foreign market entry strategy nor an international market exists, the choice of entry strategy depends on the selected foreign market and vice versa (Liuhto, 2002). In the hierarchy of strategic decisions, a selection of eco-innovation strategy is made in the pre-internationalization phase after the initial decision to internationalize, new foreign market selection, and the traditional foreign market entry pathway. Figure 1.9 presents a hierarchical structure of the decision problem of the selection of the eco-innovation strategy in the pre-internationalization and serves as a starting point for empirical research. This organization of the decision problem as a hierarchical structure is dedicated to quantifying relative decision-impacting criteria to select the best eco-innovation strategy alternative (Kahraman et al., 2015).

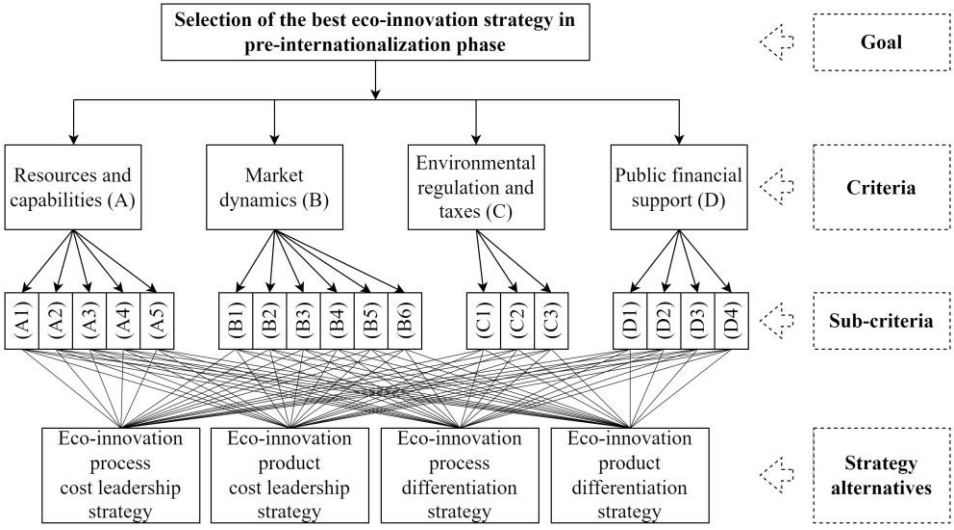


Fig. 1.9. Hierarchical structure of the decision problem
(source: created by the author)

The empirical evidence supports the positive impact of eco-innovation on the development of internationalization and the eco-innovation strategy plays an overwhelming role in the success of the internationalization of the business company. Therefore, the framework and hierarchical structure of the decision problem serve as the foundation for the empirical part of this dissertation, on which the subsequent empirical research is carried out.

1.6. Conclusions of the First Chapter and Formulation of the Objectives of the Dissertation

1. After the analysis of the scientific literature investigating the problematic and theoretical aspects of eco-innovation strategy in the development of internationalization, the relevance of the dissertation is justified, and the need to fill the gap in scientific knowledge in this relatively little-researched area is established.
2. The analysis of scientific literature revealed a noticeable research gap in a comprehensive understanding of the concept of an eco-innovation strategy. Most of the studies investigate eco-innovation from the perspective of a solitary solution, isolated practices, and a non-strategic approach. Additionally, current conceptualizations of eco-innovation strategy are notably constrained, frequently overlap with an organization's environmental strategy and fall short of encompassing the full scope of the strategic approach to eco-innovation.
3. After examining different types of eco-innovations, various ways of classifying types of eco-innovations have been identified, but to justify the concept of eco-innovation strategy in comparison with solitary eco-innovation solutions, this dissertation proposed a new concept of eco-innovation strategy and four mutually exclusive and collectively exhaustive types of eco-innovation strategy, based on generic competitive strategies (cost leadership and differentiation) and benefits that derive from distinct eco-innovation types.
4. In the scientific domain, the concept of eco-innovation strategies in the development of internationalization is a relatively new phenomenon, and as a result, there are no scientific studies that classify the eco-innovation strategy selection impacting factors; however, the field of eco-innovation is very crowded with studies that investigate the drivers of eco-innovation. It is observed that the drivers of eco-innovation differ from factors considered in the strategic decision-making process; therefore, this dissertation proposes a multilevel framework (micro, meso, and macro) and classifies the factors that impact the selection of eco-innovation strategy in the pre-internationalization phase.
5. The scientific literature has revealed that strategic decisions made in the pre-internationalization phase shape the future perspective of the company's growth in international markets. Therefore, for companies to achieve success in highly competitive international markets, it is important to consider the eco-innovation strategy as an integral strategy of a

company's internationalization strategy, and the decision related to eco-innovation strategy selection should be made in the pre-internationalization phase.

6. The analysis of the scientific literature revealed the lack of a decision-support framework relevant to the selection of eco-innovation strategies in the context of internationalization. Therefore, this dissertation proposed a theoretical framework and a hierarchical structure of the decision problem of the selection of the eco-innovation strategy in the pre-internationalization phase, which serves as a starting point for empirical research.
7. It was determined that the objectives of the dissertation formulated in the Introduction do not require additional clarification.

2

Methodology for Rational Selection of Eco-Innovation Strategy in the Pre-Internationalization Phase

The Second Chapter describes the philosophical and methodological approach to exploring the cases of selecting an eco-innovation strategy in the pre-internationalization phase. It presents a research design of the case study and the research context, followed by information on study participants and a detailed research protocol, including the selection and justification of research methods and particularities of application of the selected methods. This chapter introduces the development, pilot study, and practical application procedures of the decision-support framework for the rational selection of eco-innovation strategy in the pre-internationalization phase.

The findings related to this chapter have been published in three scientific publications (Šūmakaris et al., 2021, 2023; Šūmakaris & Korsakienė, 2022).

2.1. Research Design

This dissertation has adopted an exploratory multiple-case study approach with a positivistic philosophical paradigm as an empirical research strategy. This ap-

proach was chosen because it allows both an in-depth examination of each selected case and the complex phenomenon selection of eco-innovation strategy in the pre-internationalization phase, as well as to develop a new theory (De Massis & Kotlar, 2014; Rashid et al., 2019). A combination of qualitative and quantitative methods was applied to explore and answer the primary empirical research question: **How do decision-makers select the best eco-innovation strategy for medium-sized manufacturing firms in the pre-internationalization phase?** By addressing this research question, it became feasible to accomplish this dissertation's aim and to propose a decision-support framework for the rational selection of the eco-innovation strategy in the pre-internationalization phase. The empirical part of this case study consists of two stages and three research streams (Fig. 2.1).

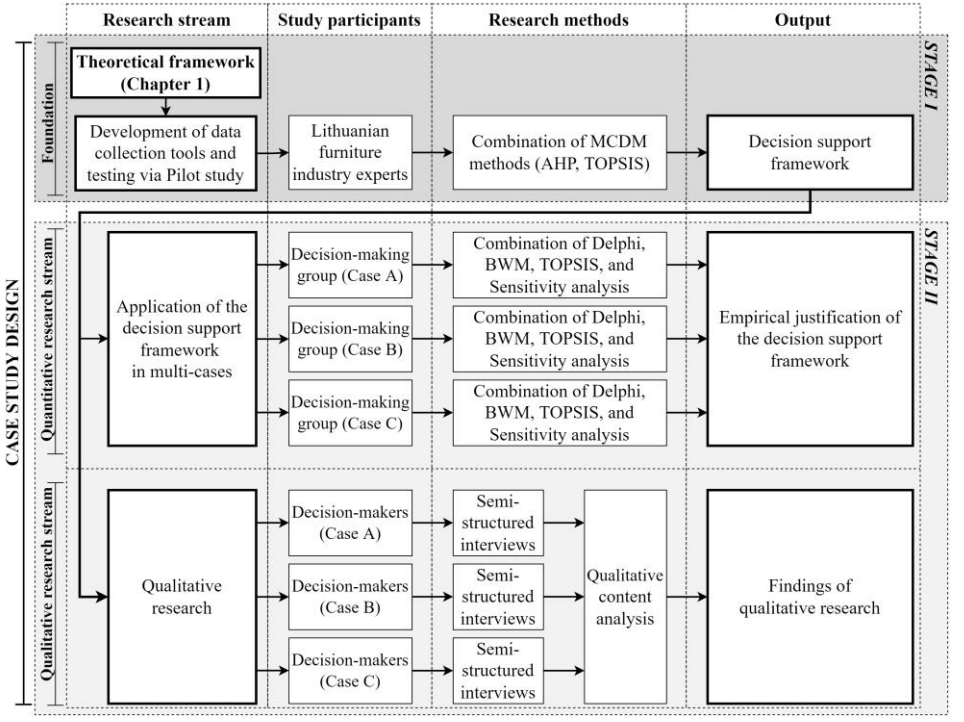


Fig. 2.1. Case study research flow (source: created by author)

Stage I.

In the first stage, a theoretical framework and a hierarchical structure of the decision problem were proposed to select the eco-innovation strategy in the pre-internationalization phase. Subsequently, the empirical research methodology with data collection tools was developed and tested through a pilot study with

industry experts (sub-chapter 2.2.1). Finally, a decision-support framework was proposed (sub-chapter 2.2.2). However, after the pilot study, the need occurred to conduct a more in-depth qualitative exploration of the strategic decision-making process related to selecting the eco-innovation strategy.

Stage II.

The second stage consists of two simultaneous research streams. A mixed inquiry technique was applied with a combination of qualitative and quantitative methods based on the guidelines (Rashid et al., 2019; Yin, 2014).

Quantitative research stream, in which the proposed decision-support framework for rational selection of eco-innovation strategy was applied in three medium-sized furniture manufacturing companies to empirically confirm the framework (sub-chapter 2.2.3).

Qualitative research stream, in which individual interviews with decision-makers from each case were conducted (sub-chapter 2.3.1) and the collected data were analyzed by applying the qualitative content analysis method (sub-chapter 2.3.2) to gain in-depth insights into the strategic decision-making process related to the selection of eco-innovation strategy in the pre-internationalization phase of business companies.

2.1.1. Case Study Design

This sub-chapter presents the case study design and type, philosophical and methodological approaches, definition of the unit of analysis, and validity and reliability considerations. According to De Massis and Kotlar (2014), case studies are one of the most adopted methods in organizational studies and have been acknowledged as an approach to generating and testing theory that has provided the mainstream management field with ground-breaking insights. Furthermore, case study research consists of a detailed investigation that helps to explore a phenomenon to provide an analysis of the context and processes involved in the phenomenon under investigation (Rashid et al., 2019).

Different philosophical traditions can be embraced in a case study (De Massis & Kotlar, 2014). However, it is beyond the scope of this dissertation to provide a detailed discussion of the philosophical assumptions of social science research, except to offer a note that this dissertation follows Yin (2014), who primarily based his approach to case study on positivism (De Massis & Kotlar, 2014; Yazan, 2015). Positivism assumes that the researcher finds or simply observes findings and obtains knowledge in an objective way (De Massis & Kotlar, 2014; Yazan, 2015). The justification for adopting the positivist philosophical paradigm is driven by this dissertation's aim and the rigor of the positivist case study research

approach to ensure validity and reliability by using clearly defined methodological guidelines (De Massis & Kotlar, 2014; Yin, 2014).

In case study research, it is essential to define the concept of a "case" to provide a foundational understanding of the subject matter under investigation. The "case" (also referred to as the "unit of analysis" (Yin, 2014)) can be defined as "a phenomenon of some sort occurring in a bounded context" (De Massis & Kotlar, 2014). In a classic case study, a "case" may be an individual and the individual is the primary unit of analysis (Yin, 2014). Therefore, information about the relevant individual would be collected, and several such individuals or "cases" might be included in a multiple-case study (Yin, 2014). However, the "case" can be some event or entity other than a single individual, and it can include a variety of topics, such as small groups, communities, decisions, programs, organizational change, etc. (Yin, 2014). Therefore, the unit of analysis for this case study is derived from the primary research question. Given the focus of this dissertation on strategic decision-making within the context of internationalization, the unit of analysis is explicitly defined as the strategic decision-making process related to the selection of eco-innovation strategy in medium-sized manufacturing firms in the pre-internationalization phase. This unit of analysis serves as the central focus of the study.

In addition to choosing a case study design and philosophical paradigm, it is important to decide what type of case study will be conducted (Yin, 2014). According to Yazan (2015) and Yin (2014), a case study is an empirical investigation that investigates the case or cases by addressing the "how" or "why" questions concerning the phenomenon of interest. According to De Massis and Kotlar (2014), exploratory case studies are typically employed to gain an understanding of how organizational dynamics or social processes work and are used when the aim is to understand how a phenomenon takes place. The selection of an exploratory multiple case study approach (instead of explanatory) is guided by the primary dissertation aim. The research was conducted iteratively and started with the primary empirical research question, which was formulated following the guidelines presented by Miles et al. (2014) and Yin (2014). To provide a more structured approach to the research and address various aspects of the research problem, the primary research question evolved into the following sub-questions, which allowed for a more detailed and comprehensive exploration of the research topic.

Primary research question: How do decision-makers select the best eco-innovation strategy for medium-sized manufacturing firms in the pre-internationalization phase?

Sub-question 1: What are the relevant criteria for selecting the best eco-innovation strategy?

Sub-question 2: How important are these criteria and sub-criteria?

Sub-question 3: What are the rankings of eco-innovation strategy alternatives?

This dissertation's research logic is based on the abductive approach, which is the middle ground between the deductive and inductive approaches (Rashid et al., 2019). Unlike induction, abduction accepts the existing theory, which might improve the theoretical strength of case analysis and is flexible enough to allow a less theory-driven research process than deduction (Rashid et al., 2019). An outcome of abductive research is a framework that provides a tentative idea of "what theory can look like" and is useful when the objective is to develop new theories and provide a platform for future research (Rashid et al., 2019). Therefore, this dissertation attempts to fill the research gap associated with eco-innovation strategies in the development of internationalization and to provide a theoretical and empirical analysis that would serve as a platform for future research. Therefore, to address the primary research question and the subsequent sub-questions, in the first stage of the empirical research, the empirical research methodology with data collection tools was developed and tested through a pilot study with industry experts. The decision-support framework is based on the combination of MCDM methods, and the rationale behind opting for quantitative methods is rooted in the requirement for a comprehensive approach to developing a decision-support framework for rational selection.

However, after a pilot study, an additional need for more in-depth exploration of the strategic decision-making process related to eco-innovation strategies in the pre-internationalization phase occurred. The primary incentive for additional in-depth exploration derived from feedback from industry experts and the complexities and novelty of the problem that arise from limited knowledge of the phenomenon under investigation in business practice and academia.

Therefore, the fourth sub-question was added. **Sub-question 4:** How are strategic decisions regarding eco-innovation made in the context of pre-internationalization? Qualitative methods were chosen to answer the additional sub-question. The main instrument for collecting empirical material was a questionnaire for semi-structured interviews with individual decision-makers of each selected case following the interview guidelines (Castillo-Montoya, 2016; Lau & Kuziemsky, 2016; Miles et al., 2014). Interviews are often the primary data source in case studies because they are a targeted, insightful, and highly efficient means of collecting rich empirical data (De Massis & Kotlar, 2014). Subsequently, qualitative content analysis was conducted to analyze the data collected through semi-structured interviews based on the guidelines presented by Bengtsson (2016), Elo et al. (2014), Elo and Kyngäs (2008), Hsieh and Shannon (2005), Miles et al. (2014). According to Bengtsson (2016), content analysis is a method that is suitable when "a researcher cannot use statistical analysis to give meaning to the data".

Finally, to assess the rigor, validity and reliability of this study, it is important to first consider the deemed number of cases included in the study. According to Yin (2014), the sampling logic should not be used. Instead, the case replications should be considered, both literal and theoretical, that are needed for the study. However, according to Marshall et al. (2013), the number of cases in multiple-case research designs mostly contains two or three cases and tends to cluster around small sample sizes. Schoch (2020) stated that in a multiple-case study, "having three to four distinct cases for comparison is probably the most cases that one can realistically handle". Following previous studies (Chiarini, 2019; Zavadskas et al., 2017) with similar goals to develop and confirm the decision-support framework, the final number of cases involved in the confirmation phase of the decision-support framework was three Lithuanian medium-sized furniture manufacturing companies.

In addition to ensuring the rigor, validity, and reliability of this study, three main criteria were grounded in this study (De Massis & Kotlar, 2014): construct validity, reliability, and external validity. Based on the "Yinian" perspective (Yazan, 2015), the author of this dissertation controlled these criteria through well-defined and well-structured procedures. First, construct validity refers to the identification of correct operational measures for the concepts being studied (Yin, 2014). Key aspects can be considered to enhance construct validity (De Massis & Kotlar, 2014): (a) it is important to triangulate data from multiple sources and to analyze from multiple perspectives; therefore, the proposed decision-support framework was applied in three different cases and the decision-makers of each case were interviewed; (b) it is advised to have key informants and other investigators review the case study report for consistency and accuracy; therefore, throughout the entire research process, intermediate results of this multiple-case study were published in international scientific peer-reviewed journals.

Second, reliability refers to demonstrating that the operations of a case study, such as the data collection procedures, can be repeated with the same results (Yin, 2014). Here, the issue involves minimizing errors and biases in the study. However, reliability from the perspective of repeatability can only be assessed for quantitative methods and not interviews (De Massis & Kotlar, 2014). Nevertheless, to enhance reliability, this dissertation follows the guidelines (De Massis & Kotlar, 2014) and presents a case study protocol and transparent information on the research process and procedures for data collection and analysis in distinct sub-chapters and annexes.

Finally, external validity refers to the definition of the domain to which a study's findings can be generalized (Yin, 2014). It is important to note that case studies do not allow for statistical generalization (i.e., such a population as an industry) (De Massis & Kotlar, 2014; Yin, 2014). However, it allows for analytical generalizations from empirical observations to theory rather than a population

(Yin, 2014). The key to ensuring external validity and generalizability is selecting "typical" cases, i.e., one or more cases that are representative of a large number of other cases (Yin, 2014). That is, the key feature of a successful and robust multiple-case study is replication (Yin, 2014). Therefore, to empirically substantiate the decision-support framework and provide an analytical generalization, in this dissertation, the proposed decision-support framework was applied (replicated) in three different manufacturing companies in the Lithuanian furniture industry that meet the same eligibility criteria (a literal replication (Yin, 2014)). The application of a decision-support framework in three different companies and the collection of empirical material from multiple sources allowed the triangulation of this case study (Yin, 2014). Table 2.1 provides a summary of the selected approaches for this study.

Table 2.1. Summary of the selected approaches (source: created by the author)

Philosophical paradigm	Positivism
Type of case study	Multiple-case study
The nature of the study	Exploratory
Logic of the research	Abductive
Inquiry techniques	Mixed: qualitative and quantitative
Primary research question	How do decision-makers select the best eco-innovation strategy for medium-sized manufacturing firms in the pre-internationalization phase?
Unit of analysis	The strategic decision-making process related to the selection of eco-innovation strategy in medium-sized manufacturing firms in the pre-internationalization phase

The subsequent sub-chapter presents the research context, followed by detailed information on study participants and eligibility criteria for selecting each case.

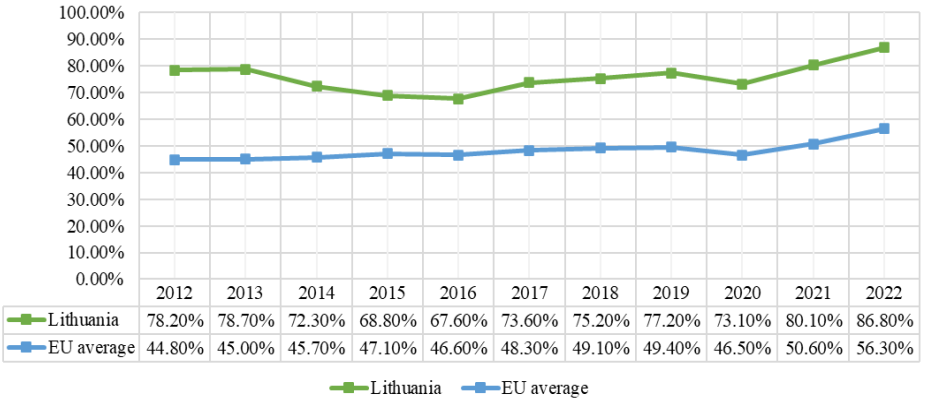
2.1.2. Research Context

The empirical study of this dissertation was conducted in the Lithuanian furniture industry, which was chosen for three reasons. First, this sector is significant for the Lithuanian economy and, especially, the export structure. Second, Lithuania's lagging progress in achieving environmental and climate policy goals makes this sector a perfect candidate for the potential to implement the eco-innovation strategy to gain a competitive advantage in new international markets. Third, the prior practical experience of this dissertation's author in the business, and especially in organizational consulting in sales and marketing, provided a high level of access

to companies within the industry and the ability to interview and survey decision-makers.

The Lithuanian furniture industry is defined according to the second edition (NACE Rev. 2)* of the European Union's official statistical classification of types of economic activity. In this classification, the manufacture of furniture corresponds to Section C, Division 31. Division C31 consists of the following classes: 31.01, manufacture of office and shop furniture; 31.02, manufacture of kitchen furniture; 31.03, manufacture of mattresses; and 31.09, manufacture of other furniture.

It is widely accepted that for small and open economies, such as Lithuania, export performance is crucial for the overall country's gross domestic product (GDP). In particular, exports make up the majority of the GDP in the economic structure of Lithuania, and in 2022 exports reached 86.80% (Eurostat) (Fig. 2.2). According to Eurostat, in 2022 exports reached 86.80% and by 30.5% exceeded the EU average (56.30%). Based on the analysis of the structure of Lithuania's export of goods by economic activities, in 2021, the main exporters and value consisted of the following five sectors: 1st, manufacturing (C) accounted for 61.83% of total Lithuania's exports; 2nd, wholesale and retail trade and repair of motor vehicles and motorcycles (G) accounted for 32.04% of total Lithuania's export; 3rd, transportation and storage (H) (2.19%); 4th, electricity, gas, steam and air conditioning supply (D) (1.27%); and finally, 5th, water supply, sewerage, waste management and remediation activities (E) (0.59%).



	2012	2013	2014	2015	2016	2017	2018	2019	2020	2021	2022
Lithuania	78.20%	78.70%	72.30%	68.80%	67.60%	73.60%	75.20%	77.20%	73.10%	80.10%	86.80%
EU average	44.80%	45.00%	45.70%	47.10%	46.60%	48.30%	49.10%	49.40%	46.50%	50.60%	56.30%

Fig. 2.2. Exports of goods and services in % of GDP (source: created by the author, according to Eurostat)

*Statistical classification of economic activities in the European Community (NACE Rev. 2) https://ec.europa.eu/eurostat/documents/3859598/5902521/KS-RA-07-015-EN.PDF

The manufacturing sector (C) accounts for more than half (61.83%) of Lithuania's total exports, and its share in the Lithuanian economy is crucial. A further analysis of the structure of exports from the manufacturing sector (C) highlights that five industries are the main contributors. In 2021, the first was the manufacture of chemicals and chemical products (C20), which accounted for 18.71% of the total manufacturing export; the second was the manufacture of food products (C10), which accounted for 12.19% of the total manufacturing export; the third was the manufacture of furniture (C31), which accounted for 11.43% of the total manufacturing export; the fourth was the manufacture of wood and of products of wood and cork, except for furniture, manufacture of articles of straw and plaiting materials (C16) (6.75%); and finally, the fifth was the manufacture of rubber and plastic products (C22) (5.32%).

However, on a global scale, the significance of the manufacturing sector is weakened by the consequences on the environment since it is recognized as one of the main contributors to environmental pollution and a challenge to sustainability (Wang & Yang, 2021). On the other hand, the manufacturing sector is also acknowledged as one of the main drivers of eco-innovation (Meng et al., 2022). In this context, manufacturing companies have the potential not only to cause environmental problems but also to solve them (Wang et al., 2022) by adopting eco-friendly products and processes aimed at minimizing negative environmental effects. Furthermore, recent geopolitical, economic, and socio-environmental crises have shifted governmental initiatives toward more focused environmental protection issues, accelerating the ongoing shift toward green transformation (The European Think Tanks Group (ETTG), 2022), which is a contextualized, multifaceted technological and socioeconomic process that is closely related to eco-innovation (Inovacijų agentūra, 2023). Likewise, the green transformation of the entire Lithuanian industry to climate-neutral production is an essential priority (Inovacijų agentūra, 2023), since the Lithuanian industry is the third largest environmental polluter in the country, emitting 15.6 % of the total amount of greenhouse gases per year (EU industry average is about 13%) (MITA, 2021).

The Lithuanian furniture industry is large, its share in the Lithuanian economy is significant, and exports are one of the fastest growing and largest in the country. According to Versli Lietuva (2020), the strengths of the sector are long-term experience, developed production infrastructure, the ability to flexibly adapt to customer needs, and the desire to create and export furniture of one's design. In 2021, the furniture industry (C31) contributed to 7.07% of all export values of Lithuanian origin and 11.43% of all manufacturing (C) exports. According to Statista, the Lithuanian furniture industry's revenue is expected to grow annually by 4.84%. At the beginning of 2021, the Lithuanian furniture industry employed around 3.0% of the total employment. A total of 2637 companies were registered in the industry at the beginning of 2021. 96.32% of them were small (1–49 persons employed), 2.81%

were medium-sized enterprises (50-249 persons employed), and 0.87% were large companies (250+ persons employed). The dominant class in the Lithuanian furniture industry is the manufacture of other furniture (C31.09), and out of the total C31 registered companies (2637 companies in 2021), C31.09 accounted for 81.42% of total companies (n = 2147). In the last ten years, the total number of companies in the C31.09 class has been growing annually from 1.08% in 2018 to 27.24% in 2013 compared to the previous year. However, the majority of the increase comes from micro and small companies (1–49 persons employed), whilst the number of medium-sized and large companies almost does not change (1–3 companies' range).

When it comes to eco-innovation, Lithuania is only beginning its journey toward the circular economy transition and currently shows lagging progress toward achieving environmental and climate policy targets (Spudyte, 2022), as Lithuania is ranked only 23rd among the 27 EU member states in the Eco-Innovation Index 2022. Although Lithuania is making considerable progress in several areas of the circular economy, such as waste management and resource and energy efficiency, up to now, the country has not had a comprehensive vision and strategy for the circular economy (Spudyte, 2022). Only recently, the Ministry of Economy and Innovation initiated the development of a sectorial roadmap focused on the industrial transition to a circular economy. The key objective is to build institutional capacity and regulatory conditions that allow all actors in the circular economy to change, cooperate, and take advantage of opportunities. Furthermore, in Lithuania, in the last EU funding period (2014–2020), according to (the Ministry of the Economy and Innovation of the Republic of Lithuania, 2020), there was no critical mass of companies that would be interested in various eco-innovation funding programs, understand the benefits of eco-innovation, and implement the eco-innovation. The overall total interest of companies in eco-innovation funding programs was very low, and only 24.65% of the intended funds were absorbed. According to the Ministry, the main barriers to eco-innovation implementation are as follows: the administrative expenses do not cover the received funds from the financing program; there is a lack of knowledge related to specialists, quality consultants and advisory about the benefits of such funding programs and eco-innovations in general; strict requirements and restrictions for applicants; and low maturity of market participants. Therefore, the challenging dimension of implementing eco-innovation practices, coupled with the overarching significance of export activities, renders the Lithuanian furniture industry particularly pertinent and worthy of exploration within the problematic area of this dissertation.

2.1.3. Participants of the Study

In this study, participants were distinguished into four separate groups. All groups were formed within the context of the Lithuanian furniture industry. The first group

was the industry expert panel that participated in the pilot study to test the empirical research methodology and data collection tools. Three decision-making groups were formed from each selected case and participated in two research streams: (i) quantitative, i.e., the application and empirical confirmation of the decision support framework, and (ii) qualitative, i.e., individual interviews with decision-makers from each company. Figure 2.3 presents the visual representation of the unit of analysis and the participant groups in the study.

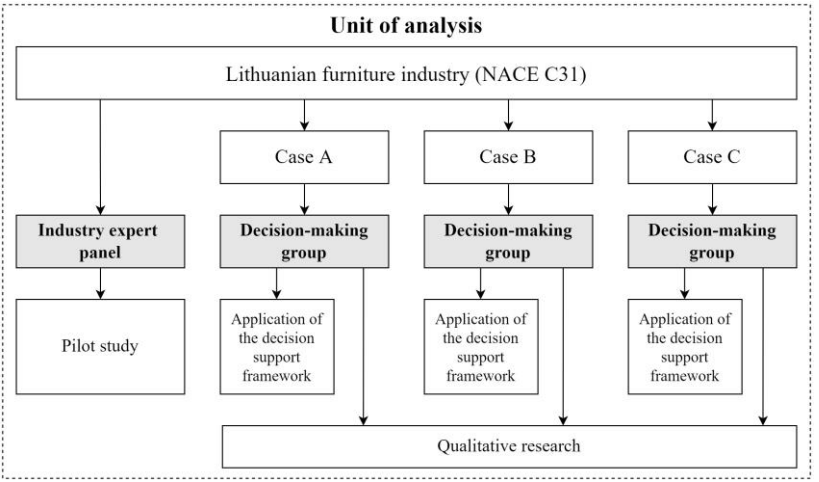


Fig. 2.3. Groups of participants in the study (source: created by the author)

A multiple-case study has been designed to show the transferability and applicability of the decision-support framework in different companies. Each case has been selected for its potential contribution to multiple case studies, and only those cases that best fit the replication design (a literal replication (Yin, 2014)) were selected.

Ethical considerations are critical to any research (Rashid et al., 2019); therefore, to protect the rights of participants and the information of companies, the author of this dissertation followed the guidelines presented by (Rashid et al., 2019). The privacy and confidentiality of companies and individuals were protected during and after the research process. To protect confidential information, the names of companies, the names of decision-makers and industry experts, and some key data that would help identify the investigated company or individual decision-makers or experts were not disclosed but reported confidentially due to the subject matter. The names of the industry experts are not disclosed due to privacy and legal rights. Experts have been codified with labels E1, E2, etc. Selected individual cases (companies) have been codified as cases A, B, and C. Finally, the

decision-makers from each company have been codified with labels DM_A1, DM_A2, DM_B1, etc. Throughout the empirical study, there was no deception at any stage of the research process, and the participants were fully aware of the goals of their participation and what to expect in the subsequent steps of the research process.

Sampling logic. First, industry experts were selected following the procedure for identifying adequate informants presented by Wagner et al. (2010). According to Wagner et al. (2010), two to five experts are needed for knowledge saturation. Libby and Blashfield (1978) suggested that research should include at least three experts, as there is a rapidly decreasing relationship between the relevance of expert opinions and their number. This shows that the assessment of a small group of experts can be just as reliable since at the eighth expert, the standard deviation almost does not change anymore (Libby & Blashfield, 1978). Moreover, according to Wagner et al. (2010), experts should not represent a sample unit in any statistical sense; instead, they are selected because they are known to be knowledgeable about the questions under investigation. Therefore, following the guidelines proposed by Lau and Kuziemsky (2016), the non-probability sampling strategy was chosen and experts were selected if they met the following criteria:

(1) the size of the represented company is a medium-sized enterprise;

(2) the expert currently occupies a managerial position in a company operating in the Lithuanian furniture industry;

(3) the expert has at least ten years of experience in a top-level management position of a business company;

(4) the expert has at least five years of experience in the international development of the business company/s;

(5) the expert has at least five years of experience in implementing eco-innovations in business company/s.

Experts were recruited through business associations and personal and professional networks, and a total of eight experts who fully met the above criteria were selected for the pilot study to test the empirical research methodology and data collection tools. The assessment of the 3rd–5th eligibility criteria was based on expert self-reported data. The final number of experts corresponds to previous MCDM studies (Kumar et al., 2020; Ullah et al., 2022; Zavadskas et al., 2017; 2021). The demographic data of industry experts who participated in the pilot study are presented in Table 2.2.

For the second stage of empirical research, to empirically justify the decision-support framework and gain in-depth insights into the phenomenon under investigation, this dissertation followed the sampling guidelines (Yin, 2014). According to Yin (2014), a sampling of eligible case candidates must start with defining a set of operational criteria that clearly defines cases that best fit the replication

design. When the eligible number of candidates is larger, a two-step screening procedure is required. The first step should consist of collecting relevant quantitative data about the entire pool, and the second step should define some relevant criteria for reducing the number of candidates (Yin, 2014).

Table 2.2. Demographic data of industry experts (source: created by the author)

Label	Education Level	Age	Position	Years of in a top-level management position	Represented Company Size
E1	Bachelor or equiv.	53	Production Manager	25	Medium-sized
E2	Master or equiv.	39	Export Manager	13	Medium-sized
E3	Bachelor or equiv.	52	Production Manager	22	Medium-sized
E4	Doctoral or equiv.	51	Marketing Manager	17	Medium-sized
E5	Bachelor or equiv.	49	Production Manager	18	Medium-sized
E6	Master or equiv.	40	Director of operations	11	Medium-sized
E7	Master or equiv.	53	CEO	21	Medium-sized
E8	Bachelor or equiv.	47	Director of operations	22	Medium-sized

Therefore, for the first step, a research context and relevant data on the entire pool were presented in sub-chapter 2.1.2. For the second step, this dissertation employed an information-oriented selection strategy, proposed by Flyvbjerg (2006), to maximize the utility of information from small samples when individual cases are selected based on expectations about their information content. Based on the defined unit of analysis, eligible case candidates (companies) were selected for the second stage of empirical research if they met the following set of criteria:

(1) the company operates in the Lithuanian furniture industry (NACE C31), and its main activity is manufacturing;

(2) the company is a medium-sized company (50–249 employees and either (i) has assets less than EUR 43 million, or (ii) the annual turnover is less than EUR 50 million);

(3) the company is in the pre-internationalization phase, which is justified by an additional two sub-criteria: (i) the company has made a strategic decision to internationalize; (ii) the company has selected the new foreign market;

(4) the company can make strategic decisions on its own and does not have a parent company, or is a part of a holding, etc.;

(5) the company has implemented eco-innovations in the last five years (product and/or process eco-innovations, such as new, more environmentally friendly machinery, environmental certificates, eco-labels, introduced recyclable packaging, toxic-free materials, etc.).

A total of three companies that fully met the above criteria were selected for the second stage of research. The selected companies were additionally evaluated during semi-structured interviews, according to eligibility criteria to exclude, if necessary, those companies that do not fall within the scope of this multiple-case study design. The key data describing the cases are presented in Table 2.3. It is important to note that some of the data are obtained through individual interviews with decision-makers; therefore, some data are self-reported, and other data are obtained from publicly available information sources, such as rekvizitai.lt; okredo.lt; b2lithuania.com; websites of companies, etc.

Table 2.3. Data of the selected cases: A, B, C (source: created by the author)

Data	**Case A**	**Case B**	**Case C**
1st eligibility criterion. The main activity of an economic entity (NACE Rev. 2)	31.09 Manufacture of other furniture	31.09 Manufacture of other furniture	31.09 Manufacture of other furniture
Average number of employees in 2018	32	55	41
2nd eligibility criterion. Average number of employees in 2023	51	58	53
Sales revenue, EUR (2018)	1.4 million	2.2 million	1.8 million
Sales revenue, EUR (2022)	2.3 million	3.1 million	2.7 million
Internationalization experience (years)	19	17	11
Number of main foreign markets (2022)	3	4	3
Main foreign markets (2022)	Germany, Norway, Sweden	Germany, Sweden, Norway, Denmark	Sweden, Norway, Denmark
Share of sales abroad % (2022)	50 approx.	60 approx.	50 approx.
3rd eligibility criterion (i). The company has made a strategic decision to enter a new foreign market	Yes	Yes	Yes
3rd eligibility criterion (ii). The newly selected foreign market(s)	Denmark	Netherlands, Belgium	Germany
4th eligibility criterion.	No	No	No

End of Table 2.3

Data	Case A	Case B	Case C
The company has a parent company or is part of a holding			
5th eligibility criterion. Main eco-innovations that have been implemented in the last 5 years	New machinery: edge banding; broadband grinding-calibration; intermediate grinding; new software: "iMOS"; new vehicles for product delivery; and minor changes in product components (fastening elements, adhesive, etc.).	New machinery: edge and radial banding; new product designs, new e-commerce platform and warehouse management system; solar power plant (100 kW); and minor changes in product components (fastening elements, adhesive, etc.).	New machinery: cutting, grinding, second painting chamber edge banding; solar power plant (60 kW); logistics/ transport: new fully electric vehicles; and minor changes in product components (fastening elements, adhesive, etc.).

In each selected case, the decision-making group was formed based on the suggestions of the executive head of each company (CEO). The CEO was asked to include in the study decision-makers who are in top-level managerial positions and are involved in the company's strategic decision-making. The demographic data of the decision-makers who participated in the study and represented each company is presented in Table 2.4.

Table 2.4. Demographic data of the decision-makers who participated in the study and represented each company (source: created by the author)

Company	Label	Education Level	Age	Current position in the company	Tenure in the company (years)	Experience (top-level management) (years)
A	DM_A1	Master or equiv.	51	CEO	21	21
	DM_A2	Bachelor or equiv.	56	Production manager	18	28
	DM_A3	Master or equiv.	34	Sales and marketing manager	11	11
B	DM_B1	Bachelor or equiv.	54	CEO	27	27
	DM_B2	Master or equiv.	39	Export manager	6	13
	DM_B3	Bachelor or equiv.	48	Production manager	10	15

End of Table 2.4

Company	Label	Education Level	Age	Current position in the company	Tenure in the company (years)	Experience (top-level management) (years)
	DM_B4	Master or equiv.	37	Marketing manager	4	11
C	DM_C1	Master or equiv.	44	CEO	10	17
	DM_C2	Bachelor or equiv.	49	Production manager	18	18
	DM_C3	Bachelor or equiv.	47	Sales manager	18	18

The CEO of each company (DM_A1; DM_B1; DM_C1) participated in both qualitative and quantitative research streams. In the quantitative research stream, i.e., the application of the decision-support framework in Case A, a total of three decision-makers participated (DM_A1; DM_A2; DM_A3), in Case B, a total of four decision-makers participated (DM_B1; DM_B2; DM_B3; DM_B4), and in Case C, a total of three decision-makers participated (DM_C1; DM_C2; DM_C3). The final number of decision-makers in each case corresponds to previous multi-criteria decision-making studies (Husain et al., 2021; Kirubakaran & Ilangkumaran, 2016; Kluczek & Gladysz, 2015; Vanegas-López et al., 2021).

However, since two research streams were conducted simultaneously, a few decision-makers refused to participate in the qualitative research stream, i.e., the individual interviews due to lack of time. Therefore, first, three decision-makers (CEOs of each company: DM_A1, DM_B1, and DM_C1) participated in individual interviews. However, after the qualitative content analysis, there was a lack of information related to the strategic eco-innovation decision-making factors (micro and meso levels). Therefore, other decision-makers were additionally asked to participate in the study, and three decision-makers agreed to participate. They provided answers related to the missing data: DM_A3, DM_B2, and DM_B3.

2.2. Development of the Decision-Support Framework

This section presents the development process of the decision-support framework for the rational selection of eco-innovation strategy in the firm's pre-internationalization phase. The purpose of the decision-support framework is not only to address the existing knowledge gap and provide a platform for future research on eco-innovation strategies in the context of internationalization, but also to aid de-

cision-makers and to adapt it to the real-world conditions of the firm's international expansion. The development of the decision-support framework is based on the following tasks:

1. Propose a decision-support framework that is based on the development of the internationalization of contemporary manufacturing firms, helping to address the main challenges of rational eco-innovation strategy selection in the pre-internationalization phase.
2. Propose a decision-support framework that would be applicable to various furniture manufacturing firms and address the specificity of individual firms, allowing to (1) critically evaluate eco-innovation strategy decision-impacting factors at the three levels, i.e., micro, meso, and macro; (2) identify individual firm strengths, weaknesses, opportunities and threats in the context of green transformation; (3) select the best strategy that is suitable within the firm's capabilities of implementing strategic green transformation.
3. Propose a decision-support framework that is within the context of internationalization and strategic decisions that are made in the pre-internationalization phase, which would allow the consideration and integration of the eco-innovation strategy with the overall firm's internationalization strategy when entering the selected new foreign market.
4. Propose a decision-support framework that increases the efficiency of the eco-innovation strategy selection process. More specifically, a framework that increases acceptability, consensus of the selected strategy, and the expenditure of time and other resources of decision-makers from manufacturing companies.

2.2.1. Pilot Study

Based on the theoretical framework and hierarchical structure of the decision problem, the empirical methodology and data collection tools were prepared and tested via a pilot study with industry experts. This sub-chapter presents the pilot study and specifically focuses on highlighting the insights gained from industry experts during the pilot study phase, primarily emphasizing the key areas of the development process and the justification for including certain methods and measures in the decision support framework.

The pilot study was carried out in the context of the Lithuanian furniture industry and was published in a scientific publication (Šūmakaris et al., 2023). The illustrated schematic diagram of the pilot study is presented in Figure 2.4, and a brief explanation of the pilot study procedure is given below.

The pilot study and the expert survey were carried out in February 2023. Each expert from the industry expert panel was introduced to the problem under investigation, the study objectives, and the concept of an eco-innovation strategy via email and phone calls to clarify any necessary information, such as what to expect next and the number of phases in the study. The experts were then asked to complete the two questionnaires step-by-step, first, AHP and second, TOPSIS. The questionnaires were filled out, and responses were received from individual experts by email. Finally, the data synthesis followed.

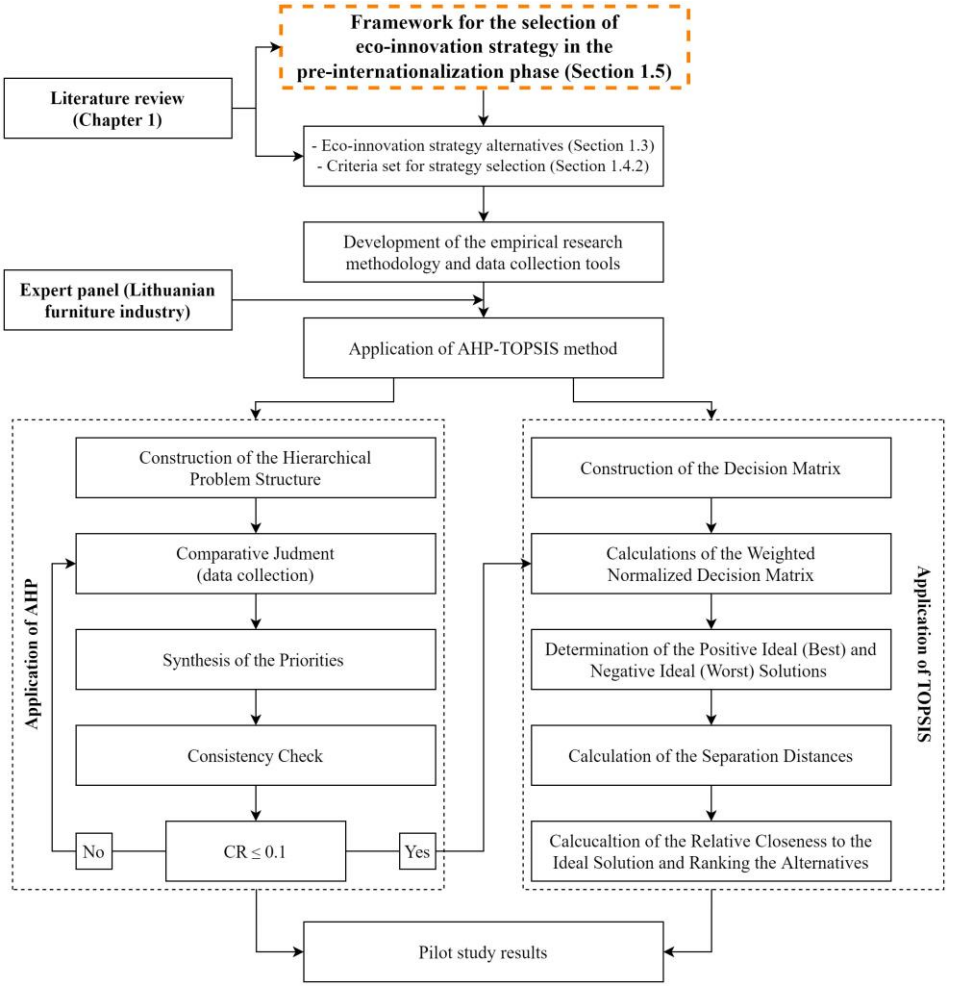


Fig. 2.4. Pilot study (source: created by the author)

A pilot study was initially designed to test instruments and data collection tools to ensure that the questionnaires did not include inadequate questions, the definitions of sub-criteria, and other provided information was complete, clearly instructed, and easy to understand and use. However, after completing the pilot study procedures, the dissertation's author contacted individual experts to express gratitude for their participation in the study and during the communication, experts provided comments and feedback related to the complexities and novelty of the problem. The key problematic areas that additionally demanded attention were:

i) phases of internationalization; experts expressed the need to clarify the pre-internationalization phase;

ii) clarity of the sub-criteria under evaluation; experts commented that some criteria (mainly environmental absorptive capacity are environmental dynamic capabilities) are difficult to evaluate because sub-criteria cover a broad spectrum of capabilities;

iii) required input; experts commented that the number of pairs of comparisons needed to complete the AHP questionnaire was overwhelming;

iv) rational evaluation; experts expressed the difficulties that arise from trying to rationally evaluate sub-criteria and compare different strategic alternatives with respect to each sub-criterion.

Therefore, after completing the pilot study, the following improvements were made based on experts' comments:

i) phases of internationalization. To counter the problem of staying within the scope of the pre-internationalization phase during the application of the decision-support framework, the problem of applying the framework was clarified, and the entrance of newly selected foreign markets was emphasized during the application procedure and in all questionnaires. Additionally, decision-makers were asked to select and keep in mind the newly selected foreign market throughout the application procedure.

ii) clarity of the sub-criteria under evaluation. The initial set of criteria and sub-criteria that derived from the theoretical analysis presented in sub-chapter 1.4.2 evolved, and multiple improvements were made. The feedback received from the pilot study experts played a significant role in shaping the subsequent evolution of the criteria set. The main modifications and improvements can be summarized as follows. First, the definitions and descriptions of various sub-criteria have been refined to provide clearer and more precise guidance. This ensures that decision-makers have a better understanding of each sub-criterion's purpose and what subject is being assessed. Second, the addition of new sub-criteria or transformation of previous ones, namely, the "environmental absorptive capacity" sub-criterion, was transformed to knowledge acquisition capabilities and green competencies, which was further split into green competencies of sales and marketing personnel and green

competencies of manufacturing personnel. The sub-criterion "environmental dynamic capabilities" was transformed into organizational structure and organizational infrastructure, and sales channels were added. These additions expand the framework's scope, allowing for a more comprehensive selection of eco-innovation strategies. The final set of criteria that were used in each case is presented in subchapter 3.2. Third, a Delphi technique was included additionally in the framework to clarify the set of criteria, obtain consensus, and lower the confusion among the decision-making group.

iii) required input to complete the AHP questionnaire. To counter the required input, the AHP method was replaced with the Best–Worst Method (BWM). BWM was selected due to lower input requirements (Gupta & Barua, 2018), i.e., fewer pairwise comparisons are needed compared to the AHP, which generates more consistent results. BWM was originally developed by Rezaei (2015) and is a relatively new MCDM method that performs better compared to existing MCDM methods in terms of consistency due to lower input requirements (Roy & Shaw, 2022). Therefore, in this dissertation, based on previous studies (Asadabadi et al., 2023; Avakh Darestani et al., 2022; Gupta & Barua, 2018) and the resulting comments from industry experts, BWM is replaced by AHP and is used to determine the weights of the criteria and sub-criteria and is used in conjunction with TOPSIS. The BWM questionnaire is presented in Annex C. Detailed information on the BWM-TOPSIS application is presented in Annex F.

iv) rational evaluation. To counter irrationality in the strategy selection process, key measures were included in the final decision support framework. First, as mentioned above, the clear definition and articulation of criteria were revised to make sure that each sub-criterion is precisely stated and understood by all decision-makers. The clarification included the integration of quantitative data and evidence into the sub-criteria where it was possible, such as the company's financial health, number of sales channels, number of green suppliers, number of external partners, number of environmental departments, etc. Second, additional auxiliary questions were added to the TOPSIS questionnaire to provide clarity on what is under evaluation and each sub-criterion for value meanings. Third, throughout the application procedure, decision-makers were encouraged to discuss the sub-criteria with other decision-makers from the decision-making group in the context of the firm's strengths, weaknesses, opportunities, and threats, which allows for the clarification of uncertainties, the resolution of differences in opinions, and the refinement of judgments based on collective understanding. Fourth, a sensitivity analysis phase was included in the framework to test the robustness of the decision and to ensure that the results are not overly sensitive to small changes in the data, as well as to eliminate biases during the stages of data collection and analysis. Consequently, the feedback received from industry experts was a valuable input in the development of the decision-support framework.

2.2.2. Proposed Decision-Support Framework

This dissertation proposes the decision-support framework for rational selection of the eco-innovation strategy in the pre-internationalization phase by integrating the fundamental theories, concepts, and models of strategic management, innovation management, and internationalization and provides a systematic and comprehensive approach in assessing the micro-, meso-, and macro-level decision-impacting factors in the strategic decision-making process for rational selection of eco-innovation strategy in the pre-internationalization phase.

First, following the classic strategic management model (David, 2007), the proposed decision-support framework is designed to address the strategy evaluation and selection problem in all three stages. (i) Input stage. The decision-support framework acts as a summary of the basic input information needed for successful decision-making. (ii) Matching stage. The eco-innovation strategy alternatives were formulated and integrated. (iii) Decision stage. The methodology is provided to objectively evaluate strategic alternatives based on the firm-specific factors.

Second, following the classic strategic decision-making process and the evaluation of influencing environmental contextual factors that impact the strategic decision-making (Elbanna et al., 2020; Shepherd & Rudd, 2014), the decision-support framework is designed to aid decision-makers in systematic assessment of micro-, meso-, and macro-level environment factors that impact the selection of eco-innovation strategy in the pre-internationalization phase.

Third, following the classic normative decision-making process (Simon, 1955, 1960; 1978), the decision-support framework is designed to address two steps: first, the decision modeling step (select criteria, formulate alternatives, select decision methods); and second, the decision-making step (implement experiments and research, evaluate results, choose the best alternative).

Fourth, following the mixed decision-making approach (Flores-Garcia et al., 2021), the decision-support framework integrates both a logical step-by-step analysis involving quantitative assessment and an intuition of the decision-maker. The main strength of the mixed decision-making approach lies in reducing personal biases and allowing the comparison of dissimilar alternatives while integrating quantitative analysis (Flores-Garcia et al., 2021).

Finally, the decision-support framework was developed by adopting a validated multistage decision-making process from previous studies, which is based on multi-criteria decision-making methodology (Al Theeb et al., 2022; Gonçalves et al., 2019; Kumar et al., 2020; Ullah et al., 2022; Zavadskas et al., 2017; 2021).

The proposed decision-support framework for rational selection of the eco-innovation strategy in the pre-internationalization phase is presented in Figure 2.6.

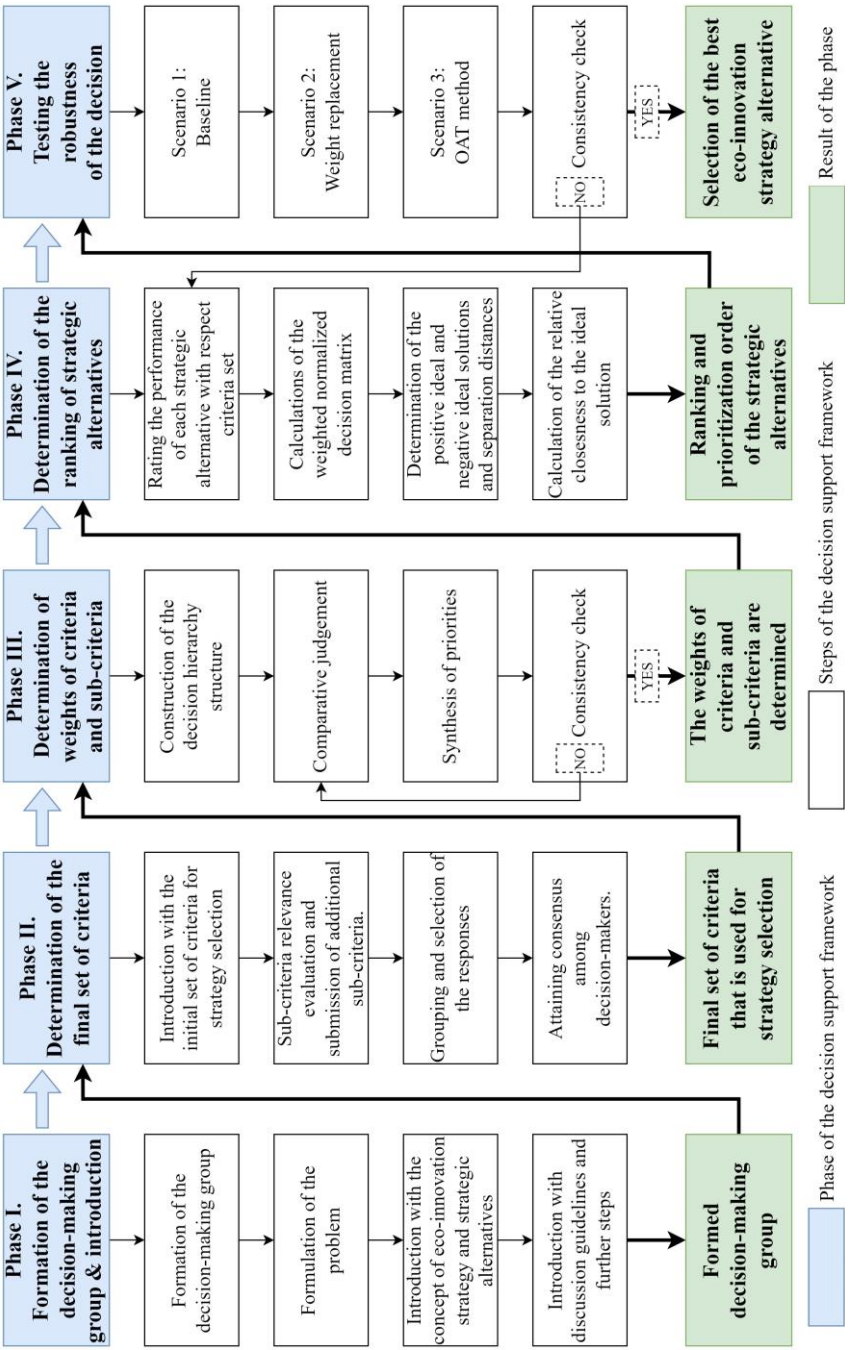


Fig. 2.5. Decision-support framework (source: created by the author)

The five main phases in utilizing the decision-support framework are as follows:

I. Formation of the problem and decision-making group;
II. Determination of the set of criteria to evaluate the strategy alternatives;
III. Determination of the weights of criteria and sub-criteria;
IV. Determination of the ranking of strategic alternatives;
V. Testing the robustness of the decision.

According to Zavadskas et al. (2017), there is no single method that could be suitable for all problems and decision-making models. However, Zavadskas et al. (2017), state that there are three main steps in utilizing any decision: (1) determining relevant criteria, (2) assessing the relative importance of the criteria, and (3) assessing the criteria with respect to alternatives to determine their rank.

Multiple previous studies have already applied a wide range of MCDM methods and different combinations in the field of strategy selection and eco-innovation, which is presented in Annex A. The most common MCDM methods used in the field of strategic management and decision-making are Analytic Hierarchy Process (AHP); Technique for Order Preference by Similarity to Ideal Solution (TOPSIS); Analytic Network Process (ANP); Decision-Making Trial and Evaluation Laboratory (DEMATEL); Complex Proportional Assessment (COPRAS); Preference Ranking Organization Method for Enrichment of Evaluation (PROMETHEE); VlseKriterijumska Optimizacija I Kompromisno Resenje (VIKOR). Basílio et al. (2022) applied a systematic literature review to investigate applied MCDM methods and combinations of different MCDM methods and concluded that AHP was by far the most commonly applied method, followed by TOPSIS. However, each MCDM method has its advantages and disadvantages, as evidenced by Kraujalienė (2019) in a comparative analysis of multi-criteria decision-making methods.

Aiming to address the limitation of the application of a single MCDM method, this dissertation adopted a validated multistage decision-making process that includes the combination of different MCDM methods from previous studies (Al Theeb et al., 2022; Gonçalves et al., 2019; Kumar et al., 2020; Ullah et al., 2022; Zavadskas et al., 2017; 2021). The combination of two or more MCDM methods allows one method to compensate for the weaknesses of other MCDM methods and can be adapted to solve specific problems (Al Theeb et al., 2022). The combination of different MCDM methods in the decision-support framework is presented in Figure 2.6.

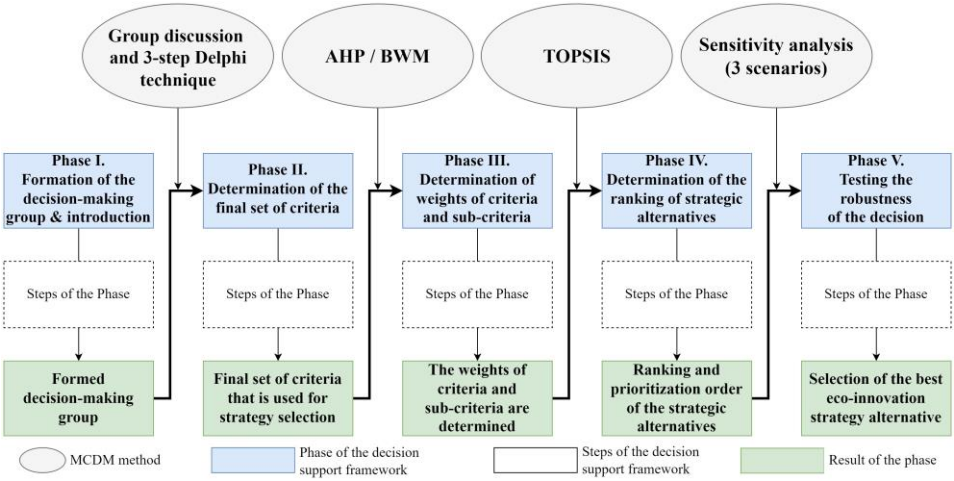


Fig. 2.6. Combination of different MCDM methods in the phases of the decision-support framework (source: created by the author)

First, a group decision-making approach (Gonçalves et al., 2019; Zavadskas et al., 2017) is the foundation of this decision-support framework and was selected to enrich the contributions of experienced decision-makers, who are usually specialists in the decision problem under analysis (Gonçalves et al., 2019). Some of the advantages of group decision-making that are relevant to this dissertation include the following. According to Lunenburg (2010), one of the main advantages is the greater sum of total knowledge, when gaps in the knowledge of one person can be filled by another. Moreover, there is an increased acceptance of a decision when more people are involved and committed to it; therefore, it is more likely the decision will be implemented successfully. Also, better comprehension of a problem and decision, when more people understand a decision when it is reached by a group. According to Salo and Hämäläinen (2010), MCDM methods can admit and synthesize information about the preferences of group members and, therefore, can offer valuable insight into alternatives preferred by other participating individuals or the group as a whole. Therefore, to reach a collective decision, decision-makers express their preferences by performing a set of evaluations on a set of possible options and the final decision that is based on the opinions of all group decision-makers, is expected to lead to better results (Tabatabaei et al., 2019). Therefore, instead of individual decision-making, a group decision-making approach was incorporated into the decision-support framework and enriched by the contributions of individuals, who are usually specialists in the decision problem under analysis (Gonçalves et al., 2019).

Second, following the guidelines presented by Afshari et al. (2012) and previous studies (Schmalz et al., 2021; Ullah et al., 2022; Zavadskas et al., 2017), a 3-step Delphi technique was implemented in the decision-support framework. The need for additional clarification of sub-criteria through the Delphi technique was observed during the pilot study. Consequently, the 3-step Delphi technique was included in the framework to clarify the set of criteria, select the main criteria, and reject the less important ones based on the opinions of decision-making groups. The Delphi technique is a survey technique conducted in several rounds for structuring group communication. It is used in many disciplines and is characterized by iteration, controlled feedback, and statistical "group response" (Schmalz et al., 2021). The Delphi technique allows for dynamic adaptation to specific contexts and firms and overall changes to the sub-criteria pool now. This flexibility ensures that the framework can accommodate variations in firm characteristics and industry-specific factors.

Third, following previous studies (Al Theeb et al., 2022; Vanegas-López et al., 2021; Yang et al., 2022), the AHP was used to determine sub-criteria weights. AHP is one of the fundamental MCDM methods (Yang et al., 2022), which structures complex issues hierarchically by simplifying the evaluation of all criteria relevant to decision-making (Kumar et al., 2020). Some key advantages of AHP include its scalability to handle larger decision problems and easy adjustability to fit the decision problem (Kraujalienė, 2019). However, the AHP requires quite a large number of pairwise comparisons, which can lead to less consistent results (Gupta & Barua, 2018). Subsequently, the AHP method was replaced with the Best–Worst Method (BWM) after the pilot study because it performs better compared to existing MCDM methods (such as AHP) in terms of consistency due to lower input requirements (Roy & Shaw, 2022).

Fourth, following previous studies (Akgün & Erdal, 2019; Kluczek & Gladysz, 2015; Kumar et al., 2020), TOPSIS is used to rank the eco-innovation strategy alternatives. TOPSIS is one of the traditional methods for solving MCDM-based decision-making problems and is very effective in selecting which alternative is more suitable, in which the contribution and performance of each sub-criterion with respect to each strategic alternative are precisely rated by decision-makers (Guan & Zhao, 2022). Some key TOPSIS advantages include its simplicity, intuitive use and being an absolute evaluation tool, which does not require transformation to minimize variables (Kraujalienė, 2019).

Finally, following previous studies (Al Theeb et al., 2022; Gupta & Barua, 2018; Roy & Shaw, 2021; Wang & Cao, 2022; Yazdani et al., 2021), a sensitivity analysis is used to test the robustness of the decision and to ensure that the results are not overly sensitive to small changes in the data, as well as to eliminate biases during the stages of data collection and analysis (Gupta & Barua, 2018).

To empirically confirm the proposed decision support framework, it was applied in multiple case studies. The step-by-step application procedure is presented in the next sub-chapter.

2.2.3. Application Procedure of the Decision-Support Framework in Multi-Cases

The application procedure of the proposed decision-support framework consists of two stages: (i) preparation and (ii) application (Fig. 2.7). The goal of the preparation stage is to assess and ensure that the company meets the eligibility criteria for the application stage. The eligibility criteria for the company follow a set of operational criteria that best fit the replication design, which is described in the case study sampling section.

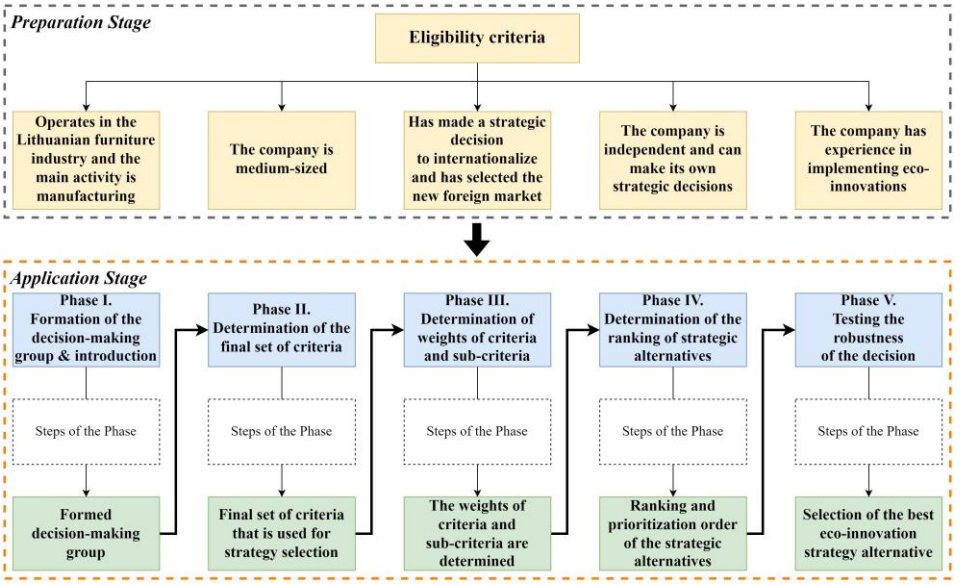


Fig. 2.7. Application procedure of the decision support framework (source: created by the author)

Second, after the evaluation according to eligibility criteria, the proposed decision-support framework was applied in three medium-sized Lithuanian furniture industry manufacturing companies that are in the pre-internationalization phase, and in each case, the application procedure was replicated. The application in all cases was conducted in August–September 2023. Each of the selected decision-

makers from the decision-making group was individually asked to fill out the necessary questionnaires step-by-step for the application of the decision-support framework via email. Additional information was provided if necessary and only on request from the decision-maker; however, the author of this dissertation made the maximum effort to ensure that when responding to the decision-maker's questions, it does not influence the decision-maker's opinion and possible responses to the questionnaire.

The detailed application procedure for each step in the five phases of the decision-support framework is provided below.

Phase I: Formulation of the problem and decision-making group. The decision-making group was formed as previously mentioned in sub-chapter 2.1.3. Each decision-maker from the group was introduced to the problem under investigation via email and phone calls to clarify the goal of the application of the framework, which is to select the best eco-innovation strategy. Decision-makers were introduced to the concept of an eco-innovation strategy and strategy alternatives. Decision-makers were asked to select and keep in mind the newly selected foreign market throughout the entire procedure. Additional guidelines and information on further steps were provided, such as what is next and how many phases there are in the strategy selection process, and gratitude was expressed for participating in this study.

Phase II: Determination of the set of criteria to evaluate the strategy alternatives. In this phase, a 3-step Delphi technique was applied to clarify the set of criteria, select the main criteria, and reject the less important ones, i.e., to finalize the set of criteria that is used in the process of selecting the best eco-innovation strategy. Each decision-maker was asked to fill out the Delphi questionnaire (Annex B) via email and was encouraged to discuss the sub-criteria with other decision-makers from the decision-making group in the context of strengths, weaknesses, opportunities, and threats of the firm. In the first Delphi step, all sub-criteria were listed with their explanations and decision-makers were asked to evaluate the relevance of each sub-criterion for decision-making based on a scale of 1 to 9, where "1" referred to "completely irrelevant" and "9" meant "extremely relevant", and to submit any missing sub-criteria that they think should be added to the sub-criteria pool. In the second step, the responses were grouped for further analysis because the submitted criteria usually have similarities and overlapping meanings (Afshari et al., 2012). The duplicates were then removed. At the end of this step, the sub-criteria were selected based on the calculation of the average score given by decision-makers and the comparison of the average score. Following the previous study (Oroojeni Mohammad Javad et al., 2020), the sub-criteria with an average score of at least seven were selected for further decision-making. In the third step, a set of criteria, including newly added sub-criteria, was returned to the decision-makers to obtain consensus among the decision-makers, and if the

consensus was not reached by the third step, the decision-makers were asked again to evaluate the relevance of the sub-criteria based on a scale of 1 to 9. At the end of this phase, the final set of criteria used for decision-making was determined.

Phase III: Determination of the weights of criteria and sub-criteria. After the final set of criteria had been established, the application of BWM followed. Each decision-maker from the company was asked to fill out the BWM questionnaire (Annex C), and the questionnaire was adjusted based on the finalized criteria in each company. Decision-makers were introduced with the goal of this questionnaire, that is, to determine the relative importance of each criterion (or sub-criterion) in the context of strategic green transformation and implementation of the eco-innovation strategy for competitive advantage in international markets. Additionally, the definitions of items were provided in the questionnaire. In this phase, the decision-maker had to first select the most important and least important criteria (or sub-criteria) from each category. Second, compare the importance of the "most important criteria" with others; and third, other criteria importance with the "least important criteria" on a scale of 1 to 9, where "1" meant "equally important" and "9" meant "extremely more important".

Phase IV: Determination of the ranking of strategic alternatives. TOPSIS was applied, and each decision-maker was asked to fill out the TOPSIS questionnaire (Annex D). The questionnaire was adjusted based on the finalized criteria in each firm. Decision-makers were introduced with the goal of this questionnaire, i.e., to rate the performance of each strategic alternative with respect to each sub-criterion. Additionally, the definitions of items were provided in the questionnaire. In this phase, the decision-maker had to rate the performance of each strategic alternative, giving a value from 1 to 10 with respect to each sub-criterion. Auxiliary questions were provided next to each sub-criterion for value (1–10) meanings. A few auxiliary question examples: "How effectively can our financial resources be used for each strategy?" (1 – ineffectively and 10 – highly effectively), "How likely would the top management support each strategy?" (1 – very unlikely and 10 – very likely); "How likely would each strategy let us gain the upper hand against competitors?" (1 – very unlikely and 10 – very likely); "How accessible is the financial support from the local or regional authorities with respect to each strategy?" (1 – not accessible and 10 – highly accessible); etc. At the end of this phase, the active participation of the decision-making group was over, and the data synthesis proceeded.

Phase V: Data synthesis and testing the robustness of the decision. The synthesis was performed to analyze the data collected from each case to answer sub-questions 1, 2, and 3 and to confirm the decision-support framework. First, the BWM–TOPSIS analysis was conducted. A summary of the BWM–TOPSIS application is presented, and a detailed step-by-step explanation of the BWM–TOPSIS application is presented in Annex F. The application of BWM is mainly

based on five steps (Rezaei, 2015). Step 1. The determination of a set of decision criteria that should be used for decision-making. Step 2. The determination of the best (i.e., most important) and the worst (i.e., least important) criteria and sub-criteria for each group of the finalized criteria set. Step 3. The determination of the preference rating for the best criterion over all other criteria using a scale of 1 to 9. Step 4. Similarly, the determination of the preference rating of all other criteria over the worst criterion using a scale of 1 to 9. Step 5. The calculation of all the criteria and sub-criteria and the finding of the optimized weights are followed by the application of TOPSIS, which is mainly based on five steps (Kumar et al., 2020). Step 1. The construction of the decision matrix to rate the performance of each strategic alternative with respect to each sub-criterion. Step 2. The data normalization and the calculations of the weighted normalized decision matrix. Step 3. The determination of the positive ideal (best) and negative ideal (worst) solutions. Step 4. The calculation of the separation distances from the ideal best and ideal worst values. Step 5. The calculation of the relative closeness of the alternative to the ideal solution and ranking of the performance order. The integration of both MCDM has been accomplished by using criteria and sub-criterion weights obtained from BWM and incorporated into TOPSIS to rank the best eco-innovation strategy alternative.

Finally, following previous studies (Al Theeb et al., 2022; Gupta & Barua, 2018; Roy & Shaw, 2021; Wang & Cao, 2022; Yazdani et al., 2021), a sensitivity analysis is performed to test the robustness of the decision and to ensure that the results are not overly sensitive to small changes in the data, as well as to eliminate biases during the stages of data collection and analysis (Gupta & Barua, 2018). In MCDM, it is convenient to perform sensitivity analyses to test the stability of the proposed framework and the final ranking (Debnath et al., 2017). Consequently, the results of MCDM are highly dependent on the preferences of decision-makers where any changes in the relative importance of the various criteria and alternatives assigned by the decision-makers may influence the final results (Al Theeb et al., 2022; Govindan et al., 2014; Kumar et al., 2020). Therefore, in this dissertation, the sensitivity analysis is used to validate the results and justify the accuracy and deviation of the decision-support framework (Kumar et al., 2020).

This dissertation performed a sensitivity analysis by varying criteria weights, with three specific areas of interest (Chen et al., 2010): (1) to investigate the stability of an evaluation by introducing a known amount of change to criteria weights; (2) to identify criteria that are especially sensitive to weight changes; and (3) to quantify changes in the rankings of criteria and evaluation. According to Yazdani et al. (2021), a robust decision structure is not influenced by changing the weights of the criteria, i.e., if the weights of some criteria are changed, the change in the final ranking will be in an acceptable range. Therefore, in this dis-

sertation, the sensitivity analysis was performed using a general mathematical formulation, creating three different scenarios by changing the weights of the aggregated criteria:

1. The first scenario is the baseline. Under this scenario, there is no change in the weights of the criteria and sub-criteria, which are exactly as assessed based on the opinion of decision-makers.
2. In the second scenario, the weight replacement strategy is used by changing the positions of different main criteria weights with other criteria weights to see the ranking pattern. The idea is to randomly modify the position of criteria weights to observe the ranking behavior (Kumar et al., 2020; Yazdani et al., 2021). Twenty-four tests were performed by varying the criteria weights to test the robustness of the decision.
3. The third scenario is used to change the weights of the main criteria by increasing or decreasing the weight of each main criterion by ±10% or ±20% at a time (better known as the OAT method (Chen et al., 2010)) to see what effect this produces on the output. The weights of the other criteria are adjusted proportionally, and the sum of all criteria weights at any per cent change must always be equal to 1 (Chen et al., 2010). Sixteen tests were performed (Resources and capabilities ±10% and ±20%; Market dynamics ±10% and ±20%; Taxes and regulations ±10% and ±20%; Public financial support ±10% and ±20%) recording the impact of the weighting variations on final prioritizing order of eco-innovation strategies.

It is expected that after the completion of all five phases of the proposed decision support framework, the best eco-innovation strategy in the pre-internationalization phase will be selected. Consequently, the analysis of the MCDM results of each case allowed answering sub-questions 1, 2, and 3 and empirically justifying the proposed decision-support framework.

2.3. Qualitative Research

After a pilot study, an additional need for a more in-depth exploration of the strategic decision-making process related to eco-innovation strategies in the pre-internationalization phase occurred. Semi-structured interviews with decision-makers and qualitative content analysis were conducted to gain in-depth insight into the phenomenon under investigation, answer sub-question 4, and explore how strategic decisions regarding eco-innovation are made in the context of pre-internationalization.

2.3.1. Data Collection Procedures for Qualitative Research

This dissertation followed the interview guidelines presented by Castillo-Montoya (2016), Hagens et al. (2009), and Lau and Kuziemsky (2016). First, an interview questionnaire and protocol were developed to ensure that interview questions align with the research question. According to Castillo-Montoya (2016), it is essential to construct an inquiry-based conversation through an interview protocol with (a) interview questions written differently from the research questions, (b) an organization following social rules of ordinary conversation, (c) a variety of questions, and (d) a script with likely follow-up and prompt questions. Therefore, the interviews were based on a standardized qualitative questionnaire that was adapted to account for additional themes that emerged as the interviews progressed, and the questionnaire consisted of complex, open-ended questions to collect data to answer research questions. However, closed-ended questions were also included in the questionnaire, mainly to additionally evaluate companies according to eligibility criteria, to confirm that the interviewee has specific experience related to the topic of the question, and a mix of situational, general, and technical questions to orient decision-makers to functional and specific topics. Nevertheless, this dissertation's author made the maximum effort not to include the questions in the questionnaire that could influence the decision-maker's opinion and possible responses. Additionally, throughout the interview process, interviewees were encouraged to provide examples of actual events and experiences.

Table 2.5. Semi-structured interview questionnaire categories and topics (source: created by the author)

Category	**Topics**
Introduction	Introduction to this study, used terminology and examples, ethics, and data confidentiality
Eligibility criteria and generic information	Eligibility criteria, interviewees' professional experience, and information about the company
Pre-internationalization phase	Importance of internationalization, decisions related to pre-internationalization, preparatory work
Decision-making related to eco-innovation	Eco-innovation importance, eco-innovation implementation experience, eco-innovation outcomes
Micro-level factors	Resources and capabilities of the firm that affect the strategic eco-innovation decisions
Meso-level factors	Market dynamics factors that affect the strategic eco-innovation decisions
Macro-level factors	Macro-level factors that affect the strategic eco-innovation decisions
Other	Anything else that the research participant thinks is important, references

The questionnaire was prepared based on the theoretical analysis in the first chapter to stay within the scope of this dissertation's theoretical framework. An interview questionnaire by categories and topics is presented in Table 2.5, and a complete questionnaire is presented in Annex E.

Subsequently, the questionnaire and protocol were developed, and the next step was to collect data; therefore, semi-structured interviews were conducted based on guidelines (Castillo-Montoya, 2016; Lau & Kuziemsky, 2016; Miles et al., 2014). This dissertation followed specific ethical matters and ethical standards based on the research ethics guidelines (Miles et al., 2014; Rashid et al., 2019). All interview participants received information on the goals and context of the research. At the beginning of each face-to-face interview, the interviewees were introduced to this study, terminology and examples, ethics, and data confidentiality. The interviewees were informed about the duration of the interview and asked if they agreed that this interview would be sound-recorded. All face-to-face interviewees were informed that the recording and handwritten notes would be used only for analysis purposes, kept confidential, and not be shared with any third party. All data collected during this interview would not be disclosed and reported confidentially. Additionally, in the chapter on the results and future publications of this dissertation, the findings are reported, and only general details about the main findings of the study are included to ensure the confidentiality of the participants.

Table 2.6. Information on data collection (source: created by the author)

Interviewees	Represented company	Data collection date	Data collection technique	Data collection duration
DM_A1	Case A	2023 September 18th	Face-to-face online meeting (MS Teams software)	70 minutes
DM_B1	Case B	2023 August 25th	Face-to-face online meeting (MS Teams software)	55 minutes
DM_C1	Case C	2023 September 14th	Face-to-face meeting at the interviewees' company	85 minutes
DM_A3	Case A	2023 December 1st – 5th	In writing via Google Docs	3 working days
DM_B2	Case B	2023 December 1st – 5th	In writing via Google Docs	3 working days
DM_B3	Case B	2023 December 1st – 5th	In writing via Google Docs	3 working days

The collection of empirical material for qualitative research occurred in two steps. First, individual interviews were conducted in July–September 2023, and the CEO of each company (DM_A1; DM_B1; DM_C1) was individually interviewed to avoid common source bias by interviewing only one of the CEOs. Subsequently, there was a lack of information related to the strategic eco-innovation

decision-making factors (micro- and meso-levels); therefore, for the second step, additional decision-makers were interviewed in writing and provided responses related to the missing data (DM_A3; DM_B2; DM_B3). For transparency and reliability, the detailed information on data collection with each participant is presented in Table 2.6.

It is important to note that according to Lau and Kuziemsky (2016), studies that collect data through interviews should ideally be collected until the data saturation point is reached, i.e., no new insights into the phenomena being examined are gained. When saturation is reached, data collection should stop in favor of comparative cross-case analysis.

However, time and budget often hinder full saturation (Lau & Kuziemsky, 2016). According to Lau and Kuziemsky (2016), in such cases, the key topics of interest need to be confirmed, e.g., by repeating emphasis from individuals in similar roles. Therefore, following the guidelines proposed by Lau and Kuziemsky (2016) to address the data saturation aspect in this dissertation, individuals in the same roles were interviewed first, i.e., in each case, the executive head of each company CEO, along with other decision-makers. Second, the key topics of interest that are deriving from the research question and sub-question 4 were confirmed as follows: (a) the importance of the eco-innovation strategy in pre-internationalization; (b) preparation for internationalization regarding the eco-innovation; (c) decision-making factors related to eco-innovation. Finally, although the inclusion of additional cases in this study may have yielded some additional insights into the phenomenon under study, it was mostly limited by the total number of medium-sized manufacturing companies that operate in the Lithuanian furniture industry (NACE C31). In 2021, the total number of medium-sized companies (C31) was 74 companies, and even fewer companies met the eligibility criteria (especially the 4th requirement: to be able to make strategic decisions on its own and not to have a parent company or be a part of a holding), which drastically limits the possibilities of including additional cases.

2.3.2. Qualitative Data Analysis Procedures

The qualitative content analysis was conducted to analyze the data collected through the semi-structured interview based on the guidelines presented by Bengtsson (2016), Elo et al. (2014), Elo and Kyngäs (2008), Hsieh and Shannon (2005), and Miles et al. (2014). According to Bengtsson (2016), content analysis is a method that is suitable when "a researcher cannot use statistical analysis to give meaning to the data". Qualitative content analysis was performed on a sequence of stages (Bengtsson, 2016).

Stage 1: Decontextualization. During this stage, the transcribed text was read to familiarize with the data and to obtain a sense of the whole before breaking it

down into smaller units of meaning. Each identified unit of meaning was labelled with a code in relation to the context. This procedure is recognized as the "open coding process" (Bengtsson, 2016). In other words, coding is an analysis, and codes are usually attached to "chunks" of data and reflect deep analysis and interpretation of the meaning of the data (Miles et al., 2014). Hence, coding was performed based on the semi-structured interview questionnaire categories and topics.

Stage 2: Recontextualization. During this stage, the original text was re-read alongside the final list of meaning units and a thorough check was done to check whether all aspects of the content had been covered in relation to the research questions.

Stage 3: Categorization. In the categorization process, themes and categories were identified based on an abductive approach when categories derive from extant theory and literature, as well as empirical material. Each of the generic categories was broken down into sub-categories to better answer the research questions. In this dissertation the main generic categories and sub-categories were established as follows: (1) category "incentives in the pre-internationalization phase" includes the following sub-categories: (i) eco-innovation strategy, (ii) process eco-innovation, and (iii) product eco-innovation; (2) category "preparation for internationalization" includes the following sub-categories: (i) eco-innovation, (ii) marketing, and (iii) production; (3) category "strategic decision-making factors (micro-level)" includes the following sub-categories: (i) employees' environmental concern, (ii) managerial environmental concern, (iii) financial resources, (iv) green competencies, (v) knowledge acquisition capabilities, (vi) organizational structure, and (vii) organizational infrastructure; (4) category "strategic decision-making factors (meso-level)" includes the following sub-categories: (i) customers' demand for green products, (ii) customers' demand for green production processes, (iii) green competitive intensity, (iv) greenness of the suppliers, and (v) social pressure; (5) category "strategic decision-making factors (macro-level)" includes the following sub-categories: (i) regulation and taxes, and (ii) financial support; (6) category "strategy for competing in international markets" includes the following sub-categories: (i) process cost-leadership, (ii) product cost-leadership, (iii) process differentiation, and (iv) product differentiation. Indicators and quotes from interviews were chosen to confirm proof for the sub-categories. To ensure traceability, the interviewees' labels are presented at the end of each quote.

Stage 4: Compilation. At this stage, realistic conclusions were drawn to attempt to answer sub-question 4. It is important to understand how the new findings correspond to the literature and whether or not the result is reasonable and logical (Bengtsson, 2016). The findings of the qualitative content analysis allowed answering sub-question 4.

2.4. Conclusions of the Second Chapter

1. The research context and the comprehensive analysis of the export structure in Lithuania, coupled with an assessment of the performance of eco-innovation, establish a highly relevant and compelling subject for exploration within the problematic area of this dissertation. Given the significance of this subject matter, the empirical study was deliberately conducted within the Lithuanian furniture industry (NACE C31). This industry presents an ideal backdrop for the in-depth investigation required to achieve the goal of this dissertation.
2. The selection of the empirical research strategy and methodology employed in this study is underpinned by the complexity and novelty of the research subject. The strategic decision-making related to eco-innovation strategy selection in the pre-internationalization phase of the firms necessitates a comprehensive and detailed examination, which is best facilitated through the chosen exploratory multiple case study approach and a combination of qualitative and quantitative research methods. This approach allows the in-depth analysis of the phenomenon under study and the examination of each selected case. Furthermore, it empowers the development of new theoretical perspectives and an enriched understanding of existing theories, aligning with contemporary management research trends.
3. The decision-support framework developed in this study is underpinned by the integration of fundamental strategic management theories and models, mixed strategic decision-making process, and MCDM methods that harness both logical step-by-step analysis and intuitive elements of eco-innovation strategy selection in the development of internationalization. Such an approach balances the need for rigorous analysis with the inherent complexity and uncertainty of strategy selection. The combined methodology allows firms to critically evaluate the factors that impact the eco-innovation strategy decisions at the micro-, meso-, and macro-levels and offers a structured and rational strategy selection process.

3

Empirical Justification of the Decision-Support Framework for Rational Selection of Eco-Innovation Strategy in the Pre-Internationalization Phase

The Third Chapter presents the empirical justification of the proposed decision-support framework and in-depth insight into the strategic decision-making process and its outcomes. It presents the empirical research results of the pilot study and the results of the practical application of the decision-support framework in multiple cases, followed by the qualitative research findings and discussion, theoretical and practical implications, limitations, and agenda for future research in the field of eco-innovation strategies in the context of internationalization with a particular focus on the pre-internationalization phase.

The findings related to this chapter have been published in two scientific publications (Šūmakaris et al., 2023; Šūmakaris & Korsakienė, 2022).

3.1. Empirical Results of the Pilot Study

The pilot study was carried out in the context of the Lithuanian furniture industry, and the purpose of the pilot study was to ensure that the empirical research instruments and data collection tools were complete, clearly instructed, and easy to understand and use. The results of the pilot study offer valuable insights into the subject matter investigated in this dissertation. Table 3.1 presents the weights of the set of criteria that were used in the pilot study.

Table 3.1. Weights of the criteria and sub-criteria (source: created by the author)

Criteria				Sub-criteria				
Criteria	**Weight**	**Ranking**	**CR**	**Label**	**Weight**	**Local ranking**	**Global weight**	**Global ranking**
Resources and Capabilities	0.3256	2	0.066	A1	0.0787	5	0.0256	13
				A2	0.2997	1	0.0976	3
				A3	0.1653	4	0.0538	9
				A4	0.2018	3	0.0657	6
				A5	0.2544	2	0.0828	5
Market Dynamics	0.4888	1	0.076	B1	0.3292	1	0.1609	1
				B2	0.1914	3	0.0936	4
				B3	0.2264	2	0.1107	2
				B4	0.0325	6	0.0159	16
				B5	0.1300	4	0.0635	7
				B6	0.0906	5	0.0443	10
Taxes and Regulations	0.0661	4	0.012	C1	0.2705	2	0.0179	14
				C2	0.1017	3	0.0067	18
				C3	0.6278	1	0.0415	11
Public Financial Support	0.1195	3	0.038	D1	0.1338	3	0.0160	15
				D2	0.5240	1	0.0626	8
				D3	0.0592	4	0.0071	17
				D4	0.2829	2	0.0338	12

The results highlight that in the process of selecting the best eco-innovation strategy, experts from the Lithuanian furniture industry evaluated the market dynamics (B) criterion as the most important (0.4888), with sub-criteria within the group as follows: customers' demand for green products (B1) (0.3292), green competitive intensity (B3) (0.2264), and customers' demand for green production processes (B2) (0.1914), followed by the resources and capabilities (A) criterion with the weight of 0.3256, with the following sub-criteria in the group: managerial environmental concern (A2) (0.2997), environmental dynamic capabilities (A5) (0.2544), and environmental absorptive capacity (A4) (0.2018). Public financial

support (D) (0.1195) is the third most important criterion, with financial support from the national government (D2) (0.5240) as the most important sub-criterion in the group. Finally, taxes and regulations (C) (0.0661) is the least important criterion, with environmental regulations or taxes expected in the future (C3) (0.6278) as the most important sub-criterion in the group.

The acceptable range of the value of the consistency ratio (CR) is ≤ 0.1, indicating that the experts' assessments are sufficiently consistent. Figure 3.1. presents the sub-criteria in descending order and a graphical view of the Pareto analysis (marked in an orange line).

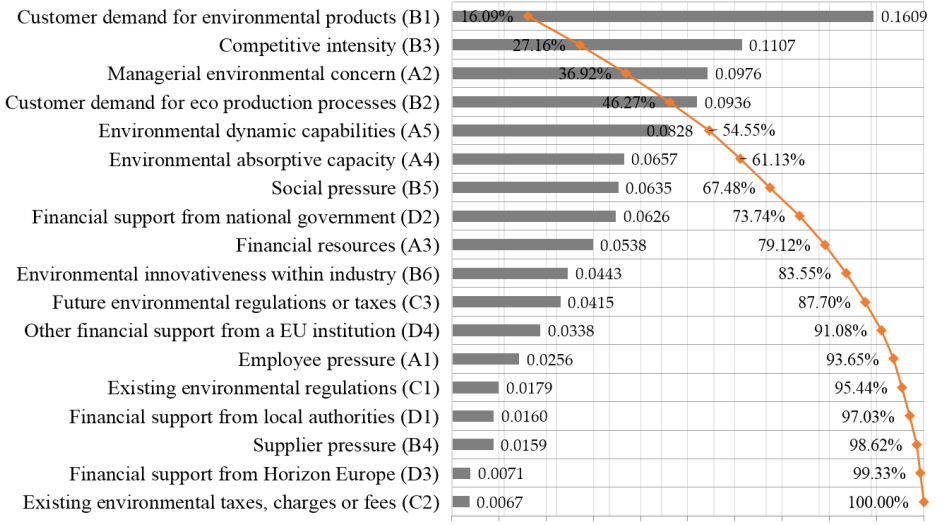


Fig. 3.1. Priority weights of sub-criteria ranking in descending order and a graphical view of Pareto analysis in the selection of eco-innovation strategy
(source: created by the author)

The Pareto analysis is based on calculating the cumulative percentage of sub-criteria global weights. The Pareto analysis demonstrates that nine sub-criteria (out of 18 in total) are the most important and take almost 80% (79.12%), i.e., B1 > B3 > A2 > B2 > A5 > A4 > B5 > D2 > A3. The importance of three meso-level environment sub-criteria can be observed: customer demand for environmental products (B1) (16.09%); competitive pressure (B3 (11.07%); customer demand for environmental production processes (B2 (9.36%), which indicates that more than a third of the decision (36.52%) in selecting the best eco-innovation strategy is based on these three sub-criteria.

Table 3.2. Final prioritizing order of eco-innovation strategies (source: created by the author)

Pilot study	D_j^*	D_j^-	CC_j^*	Rank
Eco-innovation process cost-leadership strategy	0.2276	0.3233	0.5868	2
Eco-innovation product cost-leadership strategy	0.3391	0.2325	0.4068	3
Eco-innovation process differentiation strategy	0.3516	0.1683	0.3237	4
Eco-innovation product differentiation strategy	0.1239	0.3986	0.7629	1

Further, experts were asked to rate the performance of each eco-innovation strategy alternative with respect to each sub-criterion. Table 3.2 presents the TOPSIS results of the pilot study and the final prioritizing order of eco-innovation strategy alternatives. The closer to the score to 1 means that the strategic alternative is closer to being an ideal solution. Hence, the eco-innovation product differentiation strategy achieved the highest score of 0.7629, followed by the eco-innovation process cost-leadership strategy (0.5868).

3.2. Findings of Multiple Case Study

The proposed decision-support framework was applied in three real-world cases in the context of the Lithuanian furniture industry. To finalize the set of criteria, the criteria with similarities and overlapping meanings that were derived from the Delphi technique were grouped, and duplicates were removed. For instance: (i) strengths: "Experience in implementing eco-innovations" was merged with green competencies (A4), which covers the environmental competencies of employees and managers related to the ability to understand, integrate, manage, and exploit environmental knowledge; "Top-level managers' motivation" was merged with managerial environmental concern (A2), which covers the attitudes of top management toward environmental issues and eco-innovation implementation; (ii) weaknesses: "Lack of environmental specialists" was merged with green competencies (A4); (iii) threats: "Slowing economy and customers' choice of non-green products" was merged with customers' demand, which covers the customers' demand for eco-friendly products and eco-friendly production processes; "Becoming an industry laggard" was merged with environmental innovativeness within industry (B6), which covers the technological and environmental advancement of other companies within industry; (iv) opportunities: "Potential of new customer segment" was merged with customers' demand and etc. This dissertation stresses the importance of selecting the best eco-innovation strategy compared to a strategic decision "if" the eco-innovation strategy is the best strategy for the company. Hence, each of the finalized sub-criterion that was used in the decision-making process allows the

decision maker to evaluate each eco-innovation strategy alternative with respect to each sub-criterion, i.e., there is a possible separation among the strategic alternatives with respect to each sub-criterion. The summarized list of all the criteria and sub-criteria that were used in Cases A, B, and C in the process of selecting the best eco-innovation strategy to gain competitive advantage in new international markets are presented in Table 3.3.

Table 3.3. Summarized list of criteria and sub-criteria (source: created by the author)

Criteria (label)	Sub-criteria (label)	Description	Case A	Case B	Case C
Resources and capabilities (A)	Employees' environmental concern (A1)	Refers to the attitudes and pressure of employees toward environmental issues and eco-innovation implementation	✓	✓	✓
	Managerial environmental concern (A2)	Refers to the attitudes of top management toward environmental issues and eco-innovation implementation	✓	✓	✓
	Financial resources (A3)	Refers to the financial resources of the company and overall financial health	✓	✓	✓
	Green competencies (A4)	Refers to the environmental competencies of employees and managers related to the ability to understand, integrate, manage, and exploit environmental knowledge		✓	✓
	Green competencies of sales and marketing personnel (A5)	Refers to the environmental competencies of sales and marketing personnel related to the ability to understand, integrate, manage, and exploit environmental knowledge	✓		
	Green competencies of manufacturing personnel (A6)	Refers to the environmental competencies of manufacturing personnel related to the ability to understand, integrate, manage, and exploit environmental knowledge	✓		
	Knowledge acquisition capabilities (A7)	Refers to the company's ability to identify, obtain, and acquire external environmental knowledge and the number of external partners	✓	✓	✓
	Organizational structure (A8)	Refers to intangible elements (hierarchy, structure, internal communication, and administrative apparatus (policies, and procedures, number of environmental departments)) focused on environmental protection	✓	✓	✓
	Organizational infrastructure (A9)	Refers to tangible elements (facilities, equipment, software, transport, and communication systems) that are dedicated to environmental protection	✓	✓	✓
	Sales channels (A10)	Refers to the number of sales channels and suitability in conveying environmental value		✓	

End of Table 3.3

Criteria (label)	Sub-criteria (label)	Description	Case A	Case B	Case C
Market dynamics (B)	Customers' demand for green products (B1)	Refers to customers' demand for eco-friendly products and attention to the green concept contained in products	✓	✓	✓
	Customers' demand for green production processes (B2)	Refers to customers' demand for the overall company's environmental responsibility and eco-friendly production processes	✓	✓	✓
	Green competitive intensity (B3)	Refers to the level of competitive intensity and competitive pressure for eco-products and processes, i.e., "How green are the competitors?"	✓	✓	✓
	Greenness of the suppliers (B4)	Refers to the greenness of current suppliers, the number of green suppliers, and the concentration of suppliers in the market, as well as costs related to switching supplier	✓	✓	✓
	Social pressure (B5)	Refers to other stakeholders, non-governmental organizations, environmentalists, and social demands for environmental responsibilities	✓	✓	✓
	Environmental innovativeness within the industry (B6)	Refers to the level of environmental innovativeness within the industry and technological and environmental advancement of other companies		✓	✓
Regulation and taxes (C)	Existing environmental regulations (C1)	Refers to existing environmental regulations for environmental protection, pollution, waste management, etc.	✓	✓	✓
	Existing environmental taxes, charges or fees (C2)	Refers to existing environmental taxes, charges or fees for the company's negative environmental impact	✓	✓	✓
	Regulations or taxes expected in the future (C3)	Refers to environmental regulations or taxes that are expected to occur in the future	✓	✓	✓
Public financial support (D)	Financial support from local authorities (D1)	Refers to financial support from local or regional authorities for innovation activities that help reduce the negative environmental impact	✓	✓	✓
	Financial support from the national government (D2)	Refers to financial support from the national government for innovation activities that help reduce the negative environmental impact	✓	✓	✓
	Financial support from Horizon Europe (D3)	Refers to financial support from Horizon Europe Programme for innovation activities that help to reduce the negative environmental impact			✓
	Financial support from the European Union (D4)	Refers to financial support from a European Union institution for innovation activities that help to reduce the negative environmental impact	✓	✓	✓

In each case, after the final set of criteria has been established, BWM–TOPSIS and the sensitivity analysis were applied to four eco-innovation strategy alternatives: (1) eco-innovation process cost-leadership strategy, (2) eco-innovation product cost-leadership strategy, (3) eco-innovation process differentiation strategy, and (4) eco-innovation product differentiation strategy.

3.2.1. Findings of Multi-Criteria Decision-Making Analysis

This section presents BWM–TOPSIS and sensitivity analysis results of Cases A, B, and C. First, the BWM results reflect the weights of different criteria and sub-criteria in the process of selecting the eco-innovation strategy. Only the final results of the BWM are presented. Table 3.4. presents the weights of the set of criteria that were used in Case A.

Table 3.4. Weights of the criteria and sub-criteria (Case A) (source: created by the author)

Criteria				**Sub-criteria**				
Criteria (label)	**Weight**	**Ranking**	**CR**	**Label**	**Weight**	**Local ranking**	**Global weight**	**Global ranking**
Resources and capabilities (A)	0.4177	2	0.091	A1	0.0315	8	0.0132	18
				A2	0.2884	1	0.1205	2
				A3	0.0900	6	0.0376	11
				A5	0.0852	7	0.0356	13
				A6	0.1158	4	0.0484	8
				A7	0.1037	5	0.0433	9
				A8	0.1199	3	0.0501	7
				A9	0.1655	2	0.0691	5
Market dynamics (B)	0.4305	1	0.115	B1	0.1648	3	0.0710	4
				B2	0.2472	2	0.1064	3
				B3	0.3791	1	0.1632	1
				B4	0.1242	4	0.0535	6
				B5	0.0847	5	0.0364	12
Taxes and regulations (C)	0.0869	3	0.114	C1	0.2286	3	0.0199	17
				C2	0.4762	1	0.0414	10
				C3	0.2952	2	0.0257	15
Financial support (D)	0.0649	4	0.110	D1	0.3826	2	0.0248	16
				D2	0.4551	1	0.0295	14
				D4	0.1623	3	0.0105	19

The BWM results highlight that in the eco-innovation strategy selection process in Case A, the market dynamics (B) criterion is the most important (0.4305), with sub-criteria within the group as follows: green competitive intensity (B3) (0.3791), customers' demand for green production processes (B2) (0.2472), and customers' demand for green products (B1) (0.1648). This is followed by the resources and capabilities (A) criterion with a weight of 0.4177 and sub-criteria managerial environmental concern (A2) (0.2884), organizational infrastructure (A9) (0.1655), and organizational structure (A8) (0.1199). The third most important criterion is taxes and regulations (C) (0.0869), with existing environmental taxes, charges or fees (C2) (0.4762) as the most important sub-criterion within the group. Finally, public financial support (D) (0.0649) is the least important criterion with) the most important sub-criterion of financial support from the national government (D2) (0.4551). A consistency ratio (CR) measurement was used to evaluate the consistency of the comparison system provided by the experts. The closer the CR is to a zero value, the more reliable the comparison. Therefore, the CR values (ranging from 0.091 to 0.115) lead to the conclusion that the evaluations are consistent. Table 3.5 presents the weights of the set of criteria that were used in Case B.

Table 3.5. Weights of the criteria and sub-criteria (Case B) (source: created by the author)

Criteria				**Sub-criteria**				
Criteria (label)	**Weight**	**Ranking**	**CR**	**Label**	**Weight**	**Local ranking**	**Global weight**	**Global ranking**
1	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**
Resources and capabilities (A)	0.3425	2	0.108	A1	0.0316	8	0.0108	20
				A2	0.2823	1	0.0967	4
				A3	0.1012	6	0.0346	12
				A4	0.1243	3	0.0426	6
				A7	0.1183	5	0.0405	8
				A8	0.1185	4	0.0406	7
				A9	0.1465	2	0.0502	5
				A10	0.0773	7	0.0265	15
Market dynamics (B)	0.4969	1	0.106	B1	0.3258	1	0.1619	1
				B2	0.2619	2	0.1302	2
				B3	0.2211	3	0.1099	3
				B4	0.0798	4	0.0397	9
				B5	0.0668	5	0.0332	13
				B6	0.0444	6	0.0221	16

End of Table 3.5

1	2	3	4	5	6	7	8	9
Taxes and regulations (C)	0.0717	4	0.086	C1	0.2395	2	0.0172	18
				C2	0.2361	3	0.0169	19
				C3	0.5244	1	0.0376	10
Financial support (D)	0.0888	3	0.122	D1	0.2458	3	0.0218	17
				D2	0.4010	1	0.0356	11
				D4	0.3531	2	0.0314	14

In the eco-innovation strategy selection process in Case B, the market dynamics (B) criterion is the most important (0.4969) with sub-criteria customers' demand for green products (B1) (0.3258), customers' demand for green production processes (B2) (0.2619), and green competitive intensity (B3) (0.2211). It is followed by the resources and capabilities (A) criterion with a weight of 0.3425 and sub-criteria managerial environmental concern (A2) (0.2823), organizational infrastructure (A9) (0.1465), and green competencies (A4) (0.1243). Public financial support (D) (0.0888) is the third most important criterion, with financial support from the national government (D2) (0.4010) as the most important sub-criterion within the group. Finally, the least important criterion is taxes and regulations (C) (0.0717), with regulations or taxes expected in the future (C3) (0.5244) as the most important sub-criterion within the group. The CR values (ranging from 0.086 to 0.122) lead to the conclusion that the evaluations are consistent. Table 3.6 presents the weights of the set of criteria that were used in Case C.

In the eco-innovation strategy selection process in Case C, the market dynamics (B) criterion is the most important (0.5097) with sub-criteria customers' demand for green products (B1) (0.3307), green competitive intensity (B3) (0.2697), and customers' demand for green production processes (B2) (0.1692). It is followed by the criterion of resources and capabilities (A) with a weight of 0.3154 and sub-criteria managerial environmental concern (A2) (0.2864), organizational infrastructure (A9) (0.1877), and green competencies (A4) (0.1330). Public financial support (D) (0.1015) is the third most important criterion, with financial support from the national government (D2) (0.4698) as the most important sub-criterion within the group. Finally, the least important criterion is taxes and regulations (C) (0.0734), with regulations or taxes expected in the future (C3) (0.5759) as the most important sub-criterion within the group. The CR values (ranging from 0.057 to 0.138) lead to the conclusion that the evaluations are consistent.

Further TOPSIS method followed, when experts were asked to rate the performance of each eco-innovation strategy alternative with respect to each sub-criterion. Only the final results of the TOPSIS are presented. Table 3.10. presents the final prioritizing order of eco-innovation strategy alternatives (Case A).

Table 3.6. Weights of the criteria and sub-criteria (Case C) (source: created by the author)

Criteria				**Sub-criteria**				
Criteria (label)	**Weight**	**Ranking**	**CR**	**Label**	**Weight**	**Local ranking**	**Global weight**	**Global ranking**
Resources and capabilities (A)	0.3154	2	0.103	A1	0.0365	7	0.0115	18
				A2	0.2864	1	0.0903	3
				A3	0.1105	6	0.0349	12
				A4	0.1330	3	0.0420	9
				A7	0.1239	4	0.0391	10
				A8	0.1221	5	0.0385	11
				A9	0.1877	2	0.0592	5
Market dynamics (B)	0.5097	1	0.138	B1	0.3307	1	0.1685	1
				B2	0.1692	3	0.0862	4
				B3	0.2697	2	0.1374	2
				B4	0.0647	5	0.0330	13
				B5	0.1017	4	0.0518	6
				B6	0.0641	6	0.0327	14
Taxes and regulations (C)	0.0734	4	0.057	C1	0.2759	2	0.0202	17
				C2	0.1481	3	0.0109	19
				C3	0.5759	1	0.0423	8
Financial support (D)	0.1015	3	0.090	D1	0.2181	3	0.0221	16
				D2	0.4698	1	0.0477	7
				D3	0.0569	4	0.0058	20
				D4	0.2551	2	0.0259	15

Table 3.7. Final prioritizing order of eco-innovation strategies (Case A) (source: created by the author)

Case A	D_j^*	D_j^-	CC_j^*	**Rank**
Eco-innovation process cost-leadership strategy	0.0478	0.1090	0.6952	1
Eco-innovation product cost-leadership strategy	0.0687	0.0689	0.5007	2
Eco-innovation process differentiation strategy	0.0971	0.0559	0.3652	3
Eco-innovation product differentiation strategy	0.1125	0.0362	0.2437	4

The closer to the relative closeness score (CC_j^*) to 1 means that the strategic alternative is closer to being an ideal solution. Hence, Table 3.7 shows the ranking of eco-innovation strategy alternatives in Case A as follows. The eco-innovation process cost-leadership strategy achieved the highest score of 0.6952, followed by the eco-innovation product cost-leadership strategy (2nd) (score: 0.5007), followed by the eco-innovation process differentiation strategy (3rd) (score: 0.3652),

and finally, the eco-innovation product differentiation strategy (4th) (score: 0.2437). Table 3.8 presents the final prioritizing order of eco-innovation strategy alternatives (Case B).

Table 3.8. Final prioritizing order of eco-innovation strategies (Case B) (source: created by the author).

Case B	D_j^*	D_j^-	CC_j^*	**Rank**
Eco-innovation process cost-leadership strategy	0.0889	0.0467	0.3446	3
Eco-innovation product cost-leadership strategy	0.1044	0.0245	0.1903	4
Eco-innovation process differentiation strategy	0.0650	0.0733	0.5298	2
Eco-innovation product differentiation strategy	0.0448	0.1008	0.6923	1

The ranking of eco-innovation strategy alternatives in Case B is as follows. The eco-innovation product differentiation strategy achieved the highest score of 0.6923, followed by the eco-innovation process differentiation strategy (2nd) (score: 0.5298), followed by the eco-innovation process cost-leadership strategy (3rd) (score: 0.3446), and finally, the eco-innovation product cost-leadership strategy (4th) (score: 0.1903). Table 3.9 presents the final prioritizing order of eco-innovation strategy alternatives (Case C).

Table 3.9. Final prioritizing order of eco-innovation strategies (Case C) (source: created by the author).

Case C	D_j^*	D_j^-	CC_j^*	**Rank**
Eco-innovation process cost-leadership strategy	0.0435	0.0455	0.5115	2
Eco-innovation product cost-leadership strategy	0.0682	0.0222	0.2454	4
Eco-innovation process differentiation strategy	0.0614	0.0430	0.4119	3
Eco-innovation product differentiation strategy	0.0265	0.0738	0.7355	1

The ranking of eco-innovation strategy alternatives in Case C is as follows. The eco-innovation product differentiation strategy achieved the highest score of 0.7355, followed by the eco-innovation process cost-leadership strategy (2nd) (score: 0.5115), followed by the eco-innovation process differentiation strategy (3rd) (score: 0.4119); and finally, the eco-innovation product cost-leadership strategy (4th) (score: 0.2454).

After BWM–TOPSIS, the sensitivity analysis was performed by changing the weights of the main criteria to create different scenarios and to test the robustness of the decisions. Under the first scenario (baseline), there is no change in the weights of the criteria and sub-criteria, which are assessed exactly as they are

based on expert opinions. In the second scenario, the weight replacement strategy was used to randomly change the position of different main criteria weights to observe the ranking behavior. A total of 24 tests were performed (including the baseline). In the third scenario, the OAT method was used to change the weights of the main criteria by increasing or decreasing the weight of each criterion by ±10% or ±20% at a time. The weights of the other criteria were adjusted proportionally to see what effect this produces on the output. Total of 16 tests were performed (resources and capabilities ±10% and ±20%, market dynamics ±10% and ±20%, taxes and regulations ±10% and ±20%, and public financial support ±10% and ±20%). Figure 3.2 presents the graphical representation of the sensitivity analysis results under the second scenario (Case A).

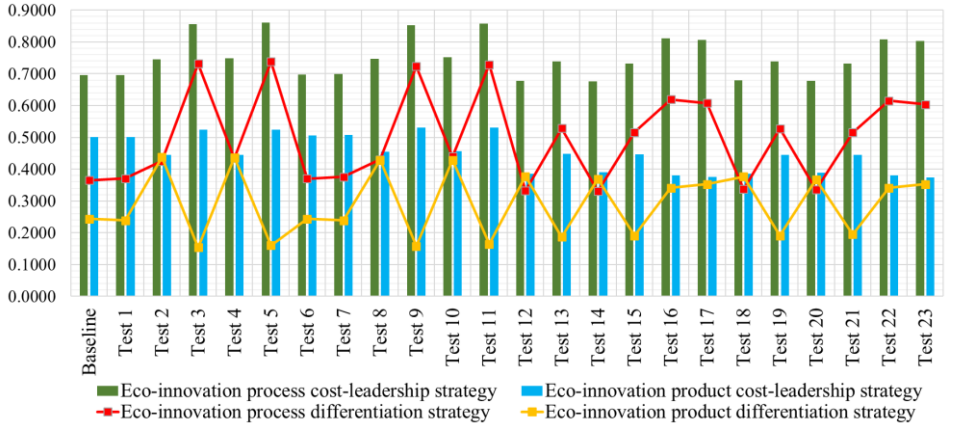


Fig. 3.2. Graphical representation of the sensitivity analysis results (2nd scenario) (Case A) (source: created by the author)

The sensitivity analysis under the second scenario demonstrates how random changes in the position of the main criteria weights affect eco-innovation strategy alternative ranking. Although random weight replacement influences the priority order of the second, third, and fourth strategy ranking, the first in the ranking (eco-innovation process cost-leadership strategy) remains the first throughout the tests, indicating that it is a robust decision since "if the weights of some criteria are changed, the change in ranking will be in an acceptable range" (Yazdani et al., 2021). Figure 3.3 presents the graphical representation of the sensitivity analysis results under the third scenario (Case A).

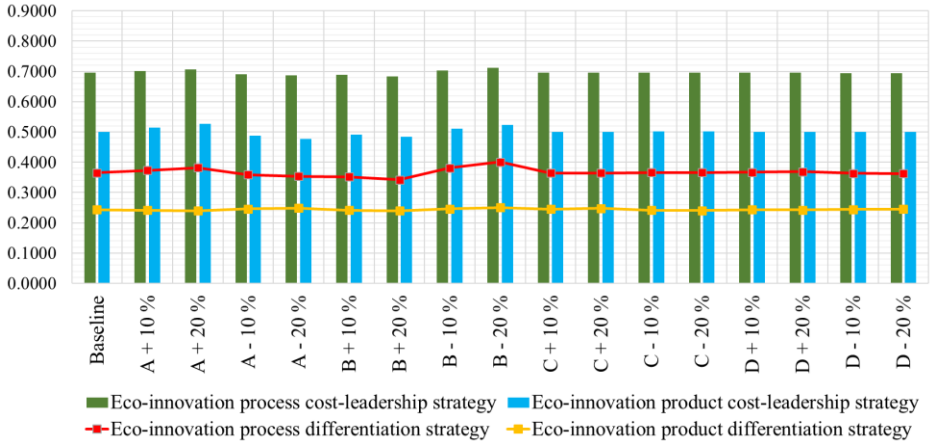


Fig. 3.3. Graphical representation of the sensitivity analysis results (3rd scenario) (Case A) (source: created by the author)

The sensitivity analysis under the third scenario demonstrates how changes in the weighting of the main criteria affect eco-innovation strategy alternative ranking. By increasing or decreasing the weight of each criterion by ±10% or ±20% and adjusting other criteria proportionally, the priority order of all eco-innovation strategy alternatives remains the same throughout the 16 tests, indicating that it is a robust decision. Figure 3.4 presents the graphical representation of the sensitivity analysis results under the second scenario (Case B).

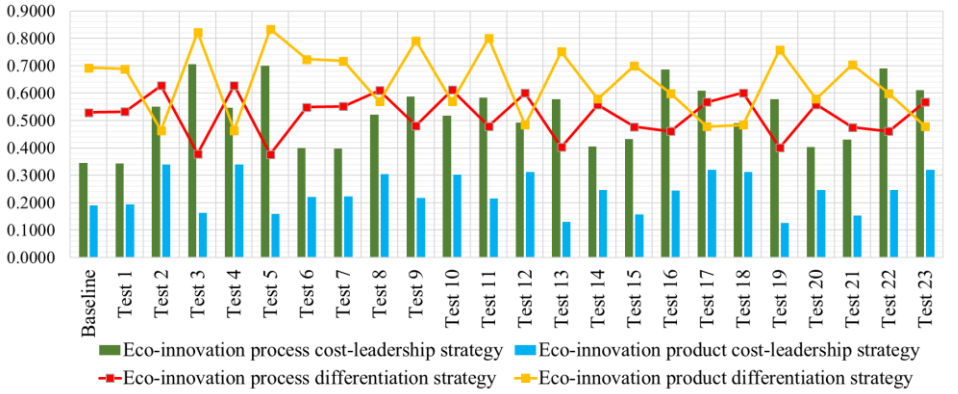


Fig. 3.4. Graphical representation of the sensitivity analysis results (2nd scenario) (Case B) (source: created by the author)

The sensitivity analysis under the second scenario reveals that random changes in the position of the main criteria weights affect eco-innovation strategy alternative ranking. As a result, it can be argued that in Case B, the weight of the parameters is a deciding factor in selecting the eco-innovation strategy.

However, it should be noted that such sensitivity analysis tests the decision in extreme conditions. First, for tests 1, 3, 5, 6, 7, 9, 11, 13, 14, 15, 19, 20, and 21, the priority order of the first eco-innovation strategy (eco-innovation product differentiation strategy) that was established in the baseline remained the same. Second, for tests 2, 4, 8, 10, 12, and 18, the first in the ranking became the eco-innovation process differentiation strategy (which is the 2nd in the baseline ranking) mainly because of the radical increase in the weight of the taxes and regulations (C) criterion (0.4969 and 0.34253, respectively). Similarly, for tests 16, 17, 22, and 23, the first in the ranking became the eco-innovation process cost-leadership strategy (which is the 3rd in the baseline ranking) mainly because of the radical increase in weights of taxes and regulations (C) and the financial support (D) criteria (0.4969 and 0.34253, respectively). Figure 3.5 presents the graphical representation of the sensitivity analysis results under the third scenario (Case B).

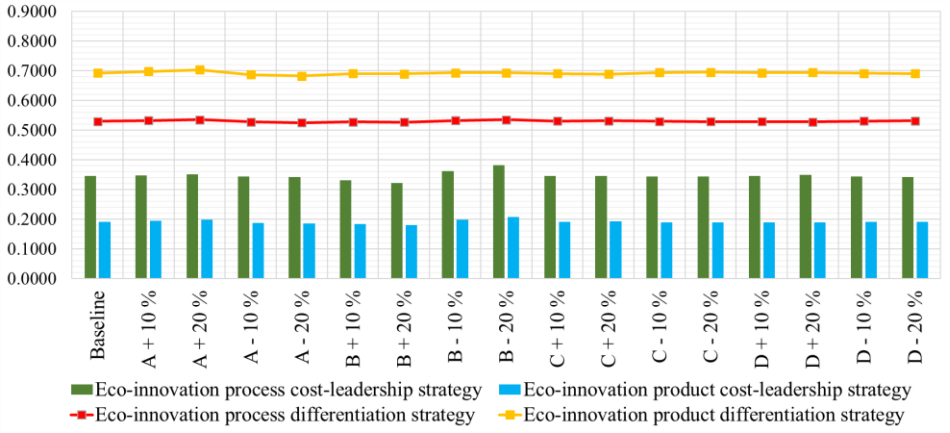


Fig. 3.5. Graphical representation of the sensitivity analysis results (3rd scenario) (Case B) (source: created by the author)

However, the sensitivity analysis under the third scenario demonstrates no changes in the priority order of all eco-innovation strategy alternatives throughout the 16 tests, indicating that it is a robust decision. Figure 3.6 presents the graphical representation of the sensitivity analysis results under the second scenario (Case C).

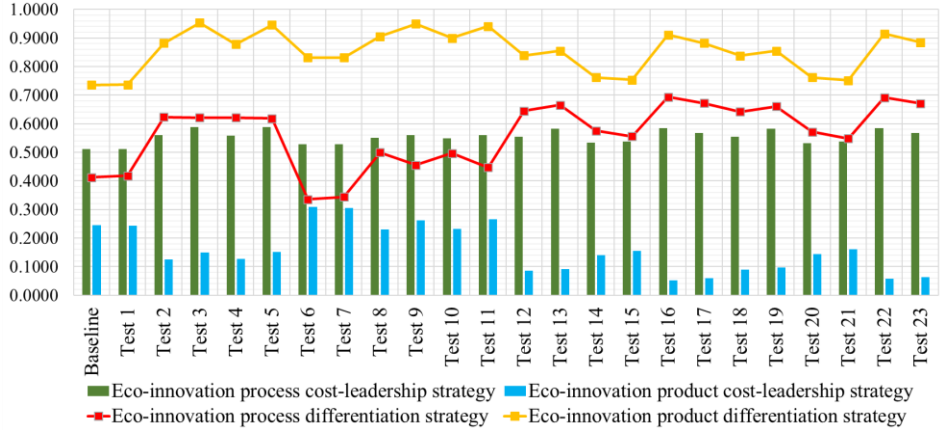


Fig. 3.6. Graphical representation of the sensitivity analysis results (2nd scenario) (Case C) (source: created by the author)

The sensitivity analysis under the second scenario demonstrates that although random weight replacement influences the priority order of the second and third strategy ranking, the first in the ranking (eco-innovation product differentiation strategy) remains the first throughout the tests, indicating that it is a robust decision. Figure 3.7 presents the graphical representation of the sensitivity analysis results under the third scenario (Case C).

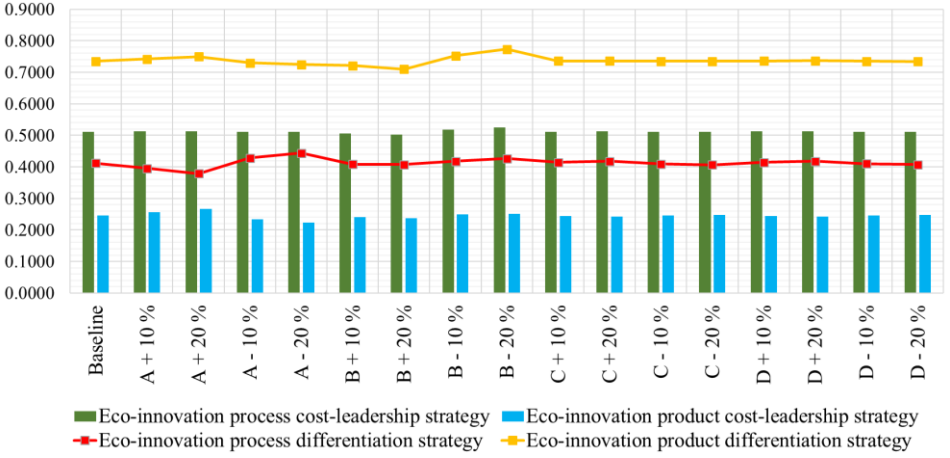


Fig. 3.7. Graphical representation of the sensitivity analysis results (3rd scenario) (Case C) (source: created by the author)

The sensitivity analysis under the third scenario demonstrates no changes in the priority order of all eco-innovation strategy alternatives throughout the 16 tests, indicating that it is a robust decision.

3.2.2. Cross-Case Results

To better understand the process of selecting the best eco-innovation strategy in the development of internationalization and the micro-, meso-, and macro-level decision-impacting factors, it is important to investigate similarities and differences in each case. Figure 3.8 presents the radar graph of priority weights of the most significant sub-criteria for Cases A, B, and C in the selection of the eco-innovation strategy.

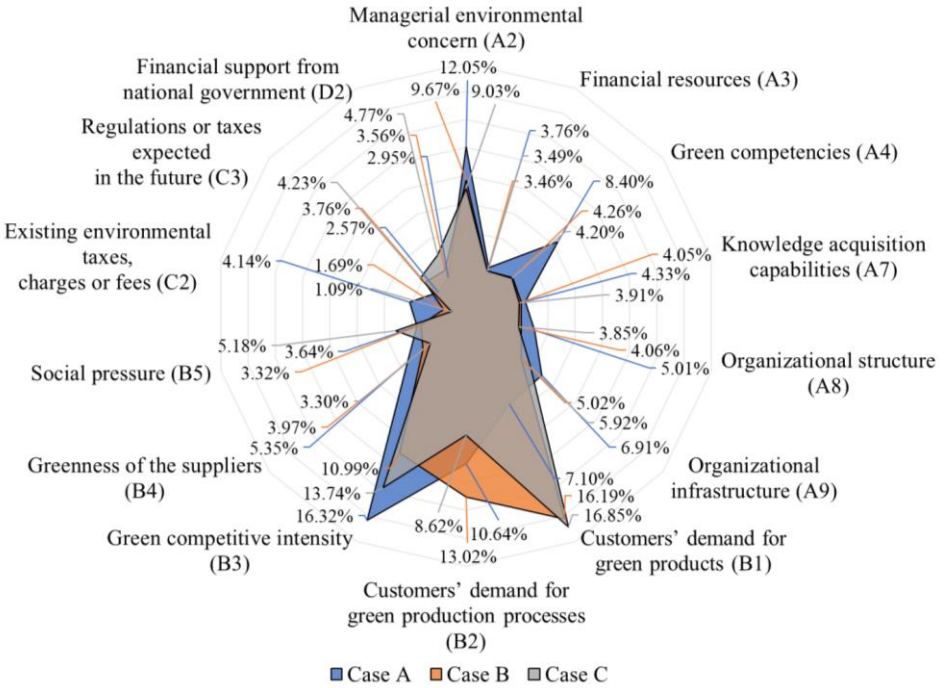


Fig. 3.8. Radar graph of priority weights of the most important sub-criteria in the selection of eco-innovation strategy (source: created by the author)

From the visual representation of the most significant sub-criteria, it can be observed that although the decision is made in each different case at the firm level, the differences in the weighting of sub-criteria are only minor. Differences in weighting are related to the following sub-criteria. Green competencies (A4) show

a difference in weighting; however, it should be noted that Case A decided to split the sub-criterion of green competencies into two different sub-criteria, i.e., (i) green competencies of manufacturing personnel and (ii) sales and marketing personnel; hence, for this comparison, the weights were added together. Another difference can be observed in the customers' demand for green products (B1) sub-criterion when Case A contrasts with lower weight (7.10%) compared to Case B (16.19%) and Case C (16.85%). Similarly, differences can be observed in the customers' demand for green production processes (B2) sub-criterion, with Case C given the lowest weight (8.62%) compared to the highest weight given by Case B (13.02%) and intermediate Case A (10.64%). Finally, the difference can be observed at the green competitive intensity (B3) sub-criterion, with Case B given the lowest weight (10.99%) compared to the highest given weight by Case A (16.32%) and intermediate Case C 13.74%). Other minor differences can be observed in Managerial environmental concern (A2) and existing environmental taxes and regulations (C2). However, most of the other sub-criteria weight differences are within the 2% range. The similarities in the weighting of sub-criteria and a few spikes of the most important sub-criteria in the selection process led to the analysis of the collective sub-criteria weights across three cases.

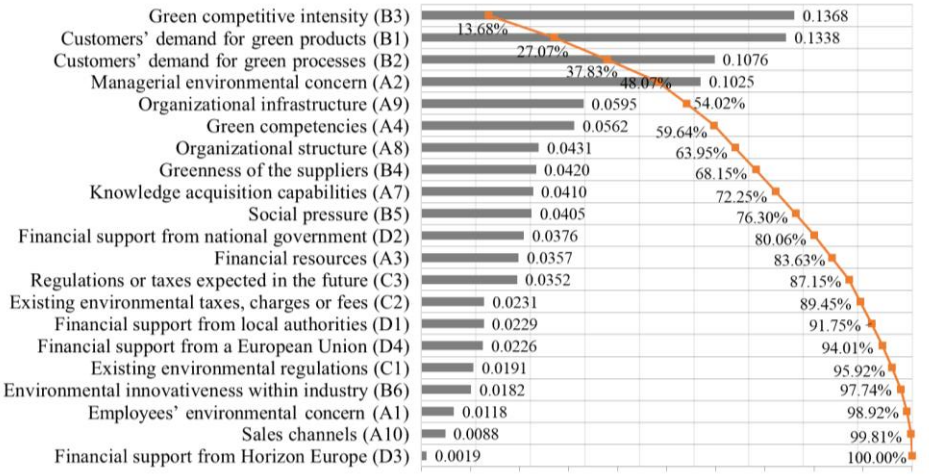
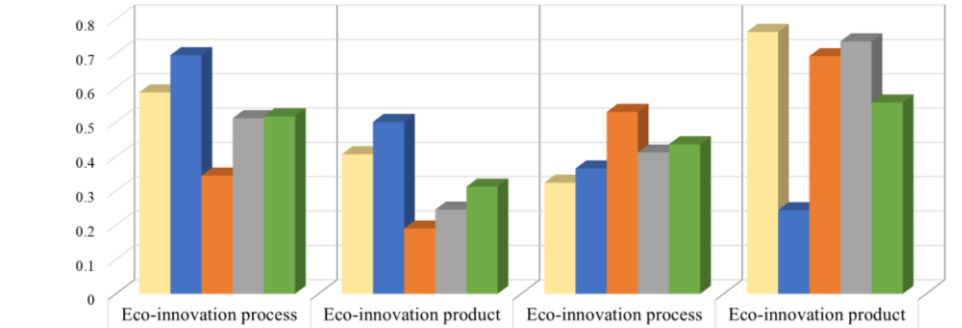


Fig. 3.9. Priority weights of collective sub-criteria and ranking in descending order and a graphical view of the Pareto analysis in the selection of eco-innovation strategy (source: created by the author)

Figure 3.9 presents the global collective weights of sub-criteria and the global ranking in descending order and a graphical view of the Pareto analysis (marked in an orange line) in the eco-innovation strategy selection process. To achieve the

collective sub-criteria weighting, the weights of all three cases were averaged. The Pareto analysis results are based on sub-criteria global weight by calculating the cumulative percentage. The Pareto analysis shows that in the process of selecting the best eco-innovation strategy to achieve competitive advantage in international markets, more than a third of the decision (37.83%) is based on the meso-level environment, of which green competitive intensity (B3) (13.68%) and customers' demand for green products (B1) take 13.38%, and customers' demand for green production processes (B2) (10.76%). Furthermore, if to include greenness of the suppliers (B4), social pressure (B5), and Environmental innovativeness within the industry (B6) sub-criteria, almost half (47.90%) of the decision is based on the meso-level environment. Similarly, more than a third of the decision (35.85%) in selecting the best eco-innovation strategy is based on the micro-level environment. Exactly a third of the decision is based on managerial environmental concern (A2) (10.25%), organizational infrastructure (A9) (5.95%), green competencies (A4) (5.62%), organizational structure (A8) (4.31%), knowledge acquisition capabilities (A7) (4.10%), and financial resources (A3) (3.57%). Finally, only 16.24% of the decision is based on the macro-level environment, i.e., adding taxes and regulations (C) and public financial support (D) criteria weights.

Similarly, to achieve the average rank of the alternatives, the relative closeness of the alternative to the ideal solution obtained from all three cases was averaged. Figure 3.10. presents the final results of the prioritization order of eco-innovation strategies.



	Eco-innovation process cost-leadership strategy	Eco-innovation product cost-leadership strategy	Eco-innovation process differentiation strategy	Eco-innovation product differentiation strategy
Pilot study	0.5868	0.4068	0.3237	0.7629
Case A	0.6952	0.5007	0.3652	0.2437
Case B	0.3446	0.1903	0.5298	0.6923
Case C	0.5115	0.2454	0.4119	0.7355
A, B, C	0.5171	0.3121	0.4356	0.5572

Fig. 3.10. Final results of the prioritization order of eco-innovation strategies (source: created by the author)

It is important to note that when averaging the relative closeness of the alternative to the ideal solution obtained from all three cases, the average number is not as relevant as the ranking order. Similarly, to the pilot study that was carried out in the context of the Lithuanian furniture industry and eight industry experts were involved, the ranking of eco-innovation strategy alternatives is very similar, with the eco-innovation product differentiation strategy being the first in the ranking and the eco-innovation process cost-leadership strategy the second.

3.3. Findings of Qualitative Research

The results of the qualitative content analysis conducted from data collected through interviews provide insight and show experiences regarding the decisions related to eco-innovation in the pre-internationalization phase.

Table 3.10. Findings from the category "Incentives in the pre-internationalization phase" (source: created by the author)

Sub-category	Indicators/comments
Eco-innovation strategy	"This [being green] is important, but not the main aspect of competing abroad… <…> we see greenness more as a trend, but it is important to keep up with the trend." (DM_A1); "Environmental friendliness is important, but it is not the first priority <…> we don't want to position ourselves abroad as an environmentally unfriendly company..." (DM_B1); "Depends a lot on the foreign market, for example, when we expanded into the Scandinavian market, we found that it [being green] was much more important compared to Lithuanian market…" (DM_C1).
Process eco-innovation	"Mainly, it comes from the need to solve some problem. <…> …we could no longer meet the volume of orders and deadlines began to be extended." (DM_A1); "We saw that the bottleneck was edging..." (DM_A1); "<…> during the Covid pandemic when sales stopped, we installed self-service systems for customers and a new warehouse management system." (DM_B1); "It depends on the situation… for example, we bought new grinding and edge banding machinery solely because of the hotel project <…> a solar power plant was installed because of the electricity prices and funding accessibility…" (DM_C1).
Product eco-innovation	"[Eco-innovations] have been implemented for very specific reasons <…> our first expectation was that it solves the grinding quality issues." (DM_A1); "We have received funding for the development of new eco-product design solutions…" (DM_B1).

The category "Incentives in the pre-internationalization phase" (Table 3.10) emphasizes the incentives that occur in the pre-internationalization phase that are related to eco-innovation. When it comes to incentives for the eco-innovation

strategy, companies consider the eco-innovation strategy in internationalization as a trend or not the first priority. However, at the same time, most interviewees understand the importance of eco-innovation strategy and the main incentive factors associated with the market level. On the contrary, when it comes to solitary eco-innovation solutions (both eco-process and eco-product), all interviewees highlight the main need to solve existing problems (micro-level) or funding availability (macro-level). The main problems are related to an increase in production capacity, a cost increase, a lack of sales channels, or quality issues. Consequently, eco-process and eco-product innovations are mainly driven and considered from an operational level of the firm and the short-term perspective in the need to solve existing problems or available funding, while the eco-innovation strategy incentives are related to the market and the positioning strategy of the companies, which according to an interviewee (DM_C1), could depend on the selected market, suggesting the idea that companies could differentiate their "greenness" depending on the market.

Table 3.11. Findings from the category "Preparation for internationalization" (source: created by the author)

Sub-category	Indicators/comments
Eco-innovation	"It wasn't like we made a decision just for the foreign markets <…> increasing production capacity is important for both foreign and Lithuanian markets." (DM_A1); "The new software was important because it made it easier to work with foreign builders and designers..." (DM_A1); "We did not make any specific decisions related to ecology for purely international development..." (DM_B1); "The increase in painting capacity allowed more orders to be made, but here are not only solutions oriented to the foreign market." (DM_C1).
Marketing	"We prepared specific marketing tools such as catalogues, brochures, website, etc." (DM_A1); "We have revised and updated the price lists." (DM_A1); "There was a discussion about opening a sales department and hiring a local manager… <…>, but we realized that it was not worth it due to the high cost of maintaining a sales showroom and paying a competitive German-level salary." (DM_A1); "We hired a market research company." (DM_B1); "We inspected and visited the competitors in that market." (DM_C1); "We selected and planned the exhibitions." (DM_C1); "We found local Lithuanian interior designers that already work in the Scandinavian market…" (DM_C1); "We knew that going to the Scandinavian market we could face this issue [environmental responsibility], so we prepared the communication and marketing tools in advance… <…> we emphasized environmental friendliness on our website…" (DM_C1).
Production	"We have evaluated the current production capacity and further necessary development priorities, such as storage facilities, painting chamber, and assembly staff…" (DM_A1).

The category "Preparation for internationalization" (Table 3.11) emphasizes the experiences and decisions made to prepare for internationalization in the pre-internationalization phase. When talking about the eco-innovations that are specifically implemented because of internationalization, most of the interviewees stated that there were no such eco-innovations and most of the implemented eco-innovations were directed toward improving the overall firm performance. Arguably, in the pre-internationalization phase, most of the previous decisions and preparation were related to traditional marketing and sales activities and no specific changes in the production processes of the companies or changes related to the quality of the product. However, a cautious assumption can be made that decisions regarding eco-innovation, made in the pre-internationalization phase, may not inherently be linked to preparation for internationalization or stem from internationalization in the first place. An exception to such an assumption is when the eco-innovations are directly related to expansion to international markets, referring to the statements of interviewees "<…> going to the Scandinavian market <…> we prepared…" (DM_C1) and "The new software <…> made it easier to work with foreign..." (DM_A1). Hence, this further suggests that the implementation of eco-innovation requires a clearly and consciously perceived problem.

Table 3.12. Findings from the category "Strategic decision-making factors (micro-level)" (source: created by the author)

Sub-category	**Indicators/comments**
Employees' environmental concern	There was no attitude or support from them, and there was no discussion as to whether the new equipment would protect nature…" (DM_A1); "…it is important to see for employees that the company invests in upgrades and that they are working in a good company…" (DM_A1); "Employees did not influence the eco-innovation decision." (DM_B3); "The employees were not very involved or influenced the decision-making; there was no support or opposition from them…" (DM_C1).
Managerial environmental concern	"Everyone [top-level managers] supported it because we solved the grinding quality issues… <…> we did not discuss the environmental protection, but the new equipment is much more efficient in terms of energy consumption." (DM_A1); "All managers agreed with the general decision." (DM_B3). It is very important since top-level management is responsible for all the decisions, including eco-innovation…" (DM_C1).
Financial resources	"Finances are always important. <…> …if you don't invest, you will lose more in the long run…" (DM_A1); "Few of the machinery we bought was used to save money (DM_A3); We usually make cost-benefit analysis before the final decision (DM_B2).

End of Table 3.12

Sub-category	Indicators/comments
Green competencies	"It is very important to be willing to change and to learn; this affects both employees and managers…" (DM_A1); "We spoke with the suppliers about the necessary competencies of the employees and sent people to training." (DM_C1); "We send people for training if necessary" (DM_B2); "It is important that salespeople can effectively communicate new changes to customers." (DM_A3).
Knowledge acquisition capabilities	"Not very important because most of the implemented solutions are known." (DM_B2).
Organizational structure	"It [eco-innovation] is important for everyone to be "on the same page"." (DM_A1). There were no occasions when we raised this question (DM_B2).
Organizational infrastructure	"It [eco-innovation] is important to be compatible with our current technology." (DM_A1).

The category "Strategic decision-making factors (micro-level)" (Table 3.12) emphasizes the factors that are considered at the firm level in the decision-making process related to the implementation of eco-innovation. When talking about what is considered in the decision process related to the implementation of eco-innovation, all interviewees made it clear that within the micro-level environment, top-level managerial support is the most important compared to employees. However, when it comes to green competencies, knowledge acquisition capabilities, and organizational infrastructure, it is not as straightforward. An interviewee (DM_A1) pointed out that willingness to change and to learn is important for both managers and employees, followed by a comment that eco-innovation needs to be compatible with current technology, which relates to another interviewee's (DM_B2) comment that knowledge acquisition capabilities are not very important because most of the implemented solutions are known. Hence, this suggests that from the solitary eco-innovations, incremental eco-innovations are preferred (without fundamentally changing the underlying core technologies) compared to radical eco-innovations (which are more complex and involve a shift in the technological regime), which require more specific green competencies, knowledge acquisition capabilities and more dramatic changes in infrastructure. Consequently, when it comes to eco-innovation strategy, which is based on a strategic green transformation through the implementation of a set of eco-innovations, the requirement for external knowledge and internal green competencies could potentially be greater. Finally, financial resources, such as liquidity, solvency, or profit, are the usual issues in the company, and it is known how to address them.

Table 3.13. Findings from the category "Strategic decision-making factors (meso-level)" (source: created by the author)

Sub-category	Indicators/comments
Customers' demand for green products	"Most improvements in the company are implemented in an effort to meet customer expectations and bring more value to our customers." (DM_A1); "Our customers do not necessarily prioritize greenness <…> they want long-lasting and high-quality furniture, and environmental friendliness is a bonus" (DM_C1); We take into account the market and the wishes of our customers." (DM_A3).
Customers' demand for green production processes	"<…> in negotiations with a foreign client, it was once requested to include in the contract the collection and disposal of old and obsolete furniture…" (DM_B1); "Sometimes, especially foreign clients, when negotiating for larger orders, ask questions related to the company's environmental responsibility and what we are doing to reduce pollution…" (DM_C1); "Most eco-innovation are implemented to emphasize the environmental responsibility of the company (DM_B2).
Green competitive intensity	"We feel pressure from our competitors, for innovations in general, not necessarily only for greenness <…> most of the improvements in the company are implemented in order to surpass the competitors…" (DM_C1); "Competitors do not influence the decision to implement eco-innovation." (DM_B2); "We monitor and analyze our competitors and try to respond accordingly." (DM_A3).
Greenness of the suppliers	"We choose suppliers based on many criteria and greenness is not necessarily a priority..." (DM_C1); "Greenness of the suppliers is important, but only to some extent." (DM_A3); "We implement eco-innovations in coordination with suppliers." (DM_B3).
Social pressure	"We want the community of our region to consider us as a socially and environmentally responsible company." (DM_C1); "We try to keep up with general trends…" (DM_A1); "We do not feel social pressure." (DM_B3).

The category "Strategic decision-making factors (meso-level)" (Table 3.13) emphasizes the factors that are considered at the market level in the decision-making process related to the implementation of eco-innovation. When talking about what is considered within the meso-level environment, all interviewees pick out several of the most important factors, such as customer demand and competitors. An interviewee (DM_C1) pointed out the pressure felt from competitors for innovations in general, not necessarily only for eco-innovations, which leads to the idea that if competitors were more actively engaged in competing with eco-innovations it could spiral the green competition. An interviewee (DM_C1) pointed out that greenness is not necessarily a priority, but longevity is, which suggests that not all environmental friendliness dimensions are fully understood by customers as well as companies themselves.

Table 3.14. Findings from the category "Strategic decision-making factors (macro-level)" (source: created by the author)

Sub-category	Indicators/comments
Regulation and taxes	"We have not considered current regulations or future changes in regulations..." (DM_C1); "Taxes are related to non-recyclable waste, but here the accounting takes care of…" (DM_A1); There was no eco-innovation that was targeted to reduce taxation (DM_B3); "For now, it doesn't really affect us, but in the future, I think it will be more challenging to meet the requirements." (DM_B2).
Financial support	"We are not interested in financing means, because in the final version it is cheaper to buy it ourselves..." (DM_A1); "We looked at financing opportunities <…> only when we had already firmly made the decision..." (DM_B1); "We got some funding for the development of the new product design and the e-commerce platform <…> it helped, but we would still do it on our own…" (DM_B1); "Irrelevant because it takes a lot of time" (DM_A3).

The category "Strategic decision-making factors (macro level)" (Table 3.14) emphasizes the factors that are considered at the macro-level in the decision-making process related to the implementation of eco-innovation. When talking about what is considered within the macro-level environment, all interviewees mentioned that existing or future environmental regulations or taxes are not particularly important when it comes to implementing eco-innovations. On the other hand, according to interviewees, public financial support is more likely to be considered in the decision-making process but not as an initial factor, which suggests that public financial support alone might not be enough to engage firms in implementing eco-innovations.

The last category, "Strategy for competing in international markets" (Table 3.15), emphasizes the strategies adopted to compete in international markets and the decisions related to eco-innovation. The last category could be considered an internationalization phase; however, the past experiences of the interviewees offer valuable insight into the investigated subject matter. First, decisions related to eco-innovation could be found within most competing strategies. However, a cautious assumption can be made that implemented eco-innovations are a part of the overall competing strategy and a secondary priority. Second, interviewees emphasize the longevity of the products, which suggests that not all environmental dimensions are fully understood and applied as a competitive strategy. Finally, eco-innovations are considered from an operational perspective and not at the strategic level when a more systematic approach is applied to evaluate and select the best set of eco-innovations compared to solitary solutions for solving existing problems.

Table 3.15. Findings from the category "Strategy for competing in international markets" (source: created by the author)

Sub-category	Indicators/comments
Process cost-leadership	"We are able to produce quickly, inexpensively and with high quality." (DM_A1); "All new machinery and software upgrades were primarily aimed at increasing turnover and productivity, but greenness is always welcome" (DM_A1); "Both saving cost and standing out from competitors are important <…> we installed a solar power plant mainly due to cost savings..." (DM_C1).
Product cost-leadership	"Our main competitive advantage is the ratio of price, quality and speed." (DM_A1).
Process differentiation	"Both saving cost and standing out from competitors are important <…> we installed a solar power plant… <…> we also use it to communicate about the company's environmental responsibility." (DM_C1); "<…> recycled wood is used for the production of furniture panels." (DM_C1); "<…> we agreed to include in the contract that unused furniture be collected for recycling…" (DM_B1).
Product differentiation	"We compete by offering uniquely and unconventionally designed furniture solutions…" (DM_B1); "The introduction of new product designs was aimed at increasing value for our customers and strengthening our competitiveness on local and international markets." (DM_B1); "The strategy does not differ between the domestic market and the foreign market <…> we produce high-quality and long-lasting furniture, which is why customers come back to us..." (DM_C1); "Our customers give priority to product quality and longevity…" (DM_C1).

Although it is not possible to generalize the findings of qualitative research to the population (Yin, 2014), the key takeaways of this empirical research contribute significantly to the existing body of knowledge.

3.4. Discussion, Theoretical and Practical Implications, Limitations, and Agenda for Future Research

This dissertation contributes significantly to the existing body of knowledge through theoretical and empirical research that results in the novel and original decision-support framework for the rational selection of eco-innovation strategy in the pre-internationalization phase of business companies. The primary research question was subdivided into four distinct sub-questions, and in this section, the key findings are highlighted and interpreted in comparison with existing empirical studies.

Sub-question 1, which explored the relevant criteria to select the eco-innovation strategy, and sub-question 2, which concerns the importance of these criteria

and sub-criteria, were addressed by the first three phases of the framework. The combination of qualitative empirical methods with the application of the decision-support framework in multi-cases allowed for a rigorous selection and assessment of the relative importance of each criterion and sub-criterion at micro-, meso-, and macro-levels, shedding light on the hierarchy of relevant criteria in the decision-making process.

Interestingly, the results indicate that in the process of selecting the best eco-innovation strategy to achieve competitive advantage in new international markets, almost half of the decision is based on the meso-level environment. To be more specific, more than a third of the decision is based on customer demand and competitive intensity. The results are in line with previous studies (Leonidou et al., 2015; Melander, 2017). Liao and Tsai (2019) argued that market pull has a greater influence on a firm's pursuit of environmental benefits than technology push. Cai and Li (2018) argued that competitive pressure is the main driver to adopt eco-innovation. Similarly, Hojnik and Ruzzier (2016) argued that fierce competition works as a driving force of eco-innovation. Hence, the high customer demand and low green competitive intensity are the deciding factors in selecting an eco-innovation strategy, arguably one factor affected by the other. Thus, the pioneering company which takes the lead in implementing an eco-innovation strategy and green transformation can enjoy the "first-mover advantage" (Przychodzen et al., 2020).

Furthermore, the results indicate that in the process of selecting the best eco-innovation strategy, the company's resources and capabilities play an overwhelming role in strategic green transformation, and more than a third of the decision is based on the micro-level environment. It is crucial to recognize that top-level management plays a pivotal role in driving strategic changes, and the selection of an eco-innovation strategy is no exception. This was supported by previous studies (Albort-Morant et al., 2018; Chen et al., 2015; Khurana et al., 2021; Lin & Chen, 2017). However, previous studies did not address the significant influence of organizational structure, infrastructure, and green competencies, underscoring the multifaceted nature of resources and capabilities required for strategic green transformation.

When it comes to the macro-level environment, it is noteworthy to mention that in the Lithuanian furniture industry, the macro-level environment exerts a relatively low influence on strategic decision-making in selecting the eco-innovation strategy. Notably, minor weights were attributed to such criteria as public financial support and environmental taxes and regulations. This leads to a broader discussion at the political level on how to foster environmental sustainability and the effectiveness of measures adopted at the macro level. Two key points stem from this observation. First, it is typical for environmental policies to focus on the meso- or macro-scale, while the green changes occur at the micro-level (Allacker

et al., 2019). Notably, environmental taxes and regulations, as well as public financial support, have demonstrated an impact, although it is limited in scope, as evidenced by previous research (García-Quevedo & Jové-Llopis, 2021; Lodi & Bertarelli, 2022; Stucki et al., 2018; Woerter et al., 2017). This limited impact may be attributed to the relatively small size of these taxes, their primary stimulation of process innovation rather than product innovation activities, and the presence of barriers that outweigh the financial gains associated with obtaining support from EU funding programs. Second, the relatively low importance of the macro-level environment may be attributed to the specific focus of this study. Many previous studies have primarily examined whether the macro-level influences firms' decisions "if" eco-innovation is implemented rather than "which" eco-innovation strategy is best suited for a company. Consequently, in the process of selecting an eco-innovation strategy, the macro-level environment may lose some of its significance when compared to the traditional government push/pull approach, which predominantly addresses the question of "if".

The sub-question 3 investigated the rankings of eco-innovation strategy alternatives. The robustness of the decision is addressed by the last phases of the decision-support framework. This quantitative analysis, coupled with the framework's assistance in a rigorous and comprehensive manner, provided a structured basis for ranking eco-innovation strategies. As evidenced by the framework's application in real-world multi-case studies, the final ranking of eco-innovation strategies is strongly contingent on the firm. Notably, the most striking observation emerges from the analysis of the rankings of both pilot study and real-world application that in the context of eco-innovation cost-leadership strategies, the most favorable alternative appears to be the strategic green transformation of the process. Conversely, in the realm of eco-innovation differentiation strategies, the strategic green transformation of the product approach prevails.

However, an interesting insight stems from the conjunction of the findings of qualitative research, the application of the decision-support framework in multiple cases, and the analysis of previous eco-innovation experiences. It appears that eco-innovation is driven by operational- and tactical-level decisions to solve existing problems (productivity, cost savings, quality issues, etc.), from which the expected outcome of eco-innovation mainly comes. The eco-process innovations are predominately implemented. On the contrary, when the decision-support framework was applied to select the best strategy to compete in new international markets, the eco-innovation product differentiation strategy was ranked the best in the pilot study with industry experts and two out of three cases. This suggests that if companies operating in the Lithuanian furniture industry consider the eco-innovation strategy from the perspective of a competitive internationalization strategy, then a different perspective emerges, and product differentiation becomes a viable niche strategy to compete in new international markets since the furniture industry

does not have a saturated line of green products. This finding opens the avenue for further studies to explore the eco-process and eco-product innovations from the perspective of longevity and strategy versus operational-level decisions.

To answer sub-question 4, which explored how strategic decisions regarding eco-innovation are made in the context of pre-internationalization, semi-structured interviews with decision-makers from each case and qualitative content analysis were conducted. Although it is not possible to generalize the findings of qualitative research to the population (Yin, 2014), i.e., the Lithuanian furniture industry, the key takeaways of this empirical study related to eco-innovation strategies in the context of internationalization and the selection of eco-innovation strategy in the pre-internationalization phase contribute significantly to the existing body of knowledge and improves the transferability of the research findings to other contexts. First, qualitative research has revealed and confirmed the current empirical studies that eco-innovations are mostly considered from an operational level of the firm and not at the strategic level when a more systematic approach is applied to evaluate and select the best set of eco-innovations compared to solitary solutions for solving existing problems. It appears that the implementation of eco-innovation requires a clearly and consciously perceived problem that is primarily related to the economic performance of the company (increasing production capacity, saving costs, etc.). Second, the "greenness" could depend on the selected market, suggesting the idea that companies could differentiate their "greenness" depending on the market. However, findings suggest that eco-innovation is a part of the overall competing strategy and a secondary priority. Therefore, it suggests that the environmental dimension within eco-innovation is not the first priority. However, "going green" is important, but only to some extent, and both dimensions of eco-innovation are relevant to companies, but the economic dimension is significantly more important. Likewise, the adoption of eco-innovation in the context of internationalization may necessitate the recognition of a consciously perceived problem, such as particular environmental certificates, green labels, or certain marketing tools. Needless to say, with the growing importance of environmental issues around the world and the consequences of economic development on the environment, the "consciously perceived problem" in international development might come sooner rather than later. The concept of eco-innovation in internationalization and "green internationalization" is important and will continue to grow, whether it currently might be considered a market-level trend, just a bonus for the customer, or not the first priority. However, it is still in the very early stages of the scientific riddle, but in contemporary business practice, "greenness" is beginning to be seen as a sustainable practice to increase the competitive advantage of the firm. The relevance of this aspect has also been evidenced in previous studies (Chai, 2022; Chen, 2022; Hojnik et al., 2018; Juniati et al., 2019; Martínez-Ros & Merino, 2023).

Having delved into the specific facets of the research problem through the examination of sub-questions, it is now time to address the primary research question: How do decision-makers select the best eco-innovation strategy for medium-sized manufacturing firms in the pre-internationalization phase? The empirical findings suggest that a clearly and widely understood direct link between eco-innovation and the development of internationalization is still notably weak. This may be a result of limited knowledge and awareness of eco-innovation strategies and their potential benefits. This is evidenced by both qualitative research findings with decision-makers and the lack of scientific literature investigating this subject. Hence, the complexities and novel aspects of the topic contribute to this weaker connection, making it challenging for decision-makers to establish a robust eco-innovation strategy as a pivotal component of the internationalization process.

It is important to note that this observation does not imply that eco-innovation strategies are inherently unimportant or irrelevant in the development of internationalization. Instead, it underscores the ongoing development of this field and the need for further research and knowledge dissemination to strengthen the link between eco-innovation strategy and internationalization. As understanding and awareness grow, decision-makers may increasingly incorporate eco-innovation strategies into their pre-internationalization planning, potentially capitalizing on the opportunities and competitive advantages they offer.

Summarizing the exploration of the strategic decision-making process and the rational selection of eco-innovation strategies in firms' pre-internationalization phase has provided valuable insights into this field. The selection of the best eco-innovation strategy in the pre-internationalization phase is a multifaceted process that depends on various factors. It is crucial to recognize that there is no one-size-fits-all approach, and the best strategy may differ from one firm to another. Therefore, decision-makers need to adopt a flexible and adaptive approach, leveraging a decision-support framework to make informed and context-specific decisions. Overall, the decision-making process is characterized by a balance between economic and environmental considerations, and firms need to consider eco-innovation strategy as an integral part of their internationalization strategy for long-term sustainability and competitiveness.

Theoretical Implications

This study makes a significant contribution to the theoretical understanding of the concept of eco-innovation strategy from the perspective of strategic management and decision-making at the firm level. This study offers several contributions and provides a comprehensive and profound insight into eco-innovation strategies in the development of internationalization, shedding light on the emerging field of "green internationalization".

First, this study takes a novel approach to the conceptualization of eco-innovation strategy from the perspective of strategic green transformation and introduces a novel definition and classification of distinct eco-innovation strategy types. By conceptualizing eco-innovation strategy from the perspective of strategic green transformation, aimed at increasing competitive advantage through four distinct strategies, this study creates an avenue for in-depth exploration of each strategy within the domain of strategic transformation. Furthermore, this conceptualization serves as a foundational step in integrating both economic and environmental dimensions into the strategic eco-innovation framework.

Second, the findings emphasize the complex nature of decision-making regarding eco-innovation strategies, suggesting that it cannot be solely attributed to driving motives but involves a multifaceted interplay of factors. This study offers valuable insights into the factors impacting the strategic decision related to the selection of eco-innovation strategy, consequently outlining a pathway for prospective research. In the domain of eco-innovation, extensive research exists concerning the driving factors of eco-innovation. However, the factors that impact the decision-making process for selecting an eco-innovation strategy have received relatively little attention. Arguably, eco-innovation driving factors differ from those factors that are considered in the strategic decision-making process. Thus, different factors are at play when firms are being driven to implement eco-innovations compared to factors that are being evaluated in the decision-making process.

Finally, the decision-support framework presented in this dissertation serves as a theoretical foundation and a platform for future research by providing a structured and comprehensive approach to understanding how firms can strategically integrate eco-innovation into their internationalization processes. This framework not only addresses the practical challenges of eco-innovation strategy selection but also contributes to the theoretical underpinning of strategic green transformation in the context of internationalization.

Practical Implications for Managers and Policy Makers

The decision-support framework developed in this dissertation offers valuable practical implications for managers and decision-makers in selecting the best eco-innovation strategy in the pre-internationalization phase. It provides a structured and systematic approach to rationally selecting the best eco-innovation strategy, considering micro-, meso-, and macro-level environmental factors in the context of internationalization and other strategic decisions in the pre-internationalization phase, ensuring that the selected strategy aligns with the goals and internationalization strategy of the company. It enables firms to make data-driven choices that

align with their objectives and resources and to make informed and strategic decisions that not only consider environmental sustainability but also contribute to their competitive advantage in the international markets by addressing the trade-offs between economic and environmental development to achieve green transformation without jeopardizing the performance of the company.

The decision-support framework developed in this study also offers valuable practical implications for policymakers and governmental bodies focusing on promoting eco-innovation and internationalization. First, policymakers can benefit from the framework's classification of eco-innovation strategies. Understanding the different types of eco-innovation strategies can guide the development of targeted policies and incentives. By tailoring their initiatives to the specific strategic focus that offers the most significant environmental and economic benefits. Second, the decision-support framework highlights the importance of considering both environmental and economic dimensions. Policymakers can use this insight to develop comprehensive policies that not only encourage green transformation but also address economic competitiveness. This balanced approach ensures that firms are motivated to adopt eco-innovation strategies that contribute to both their environmental and economic goals. Third, given the study's findings that internationalization is an essential context for eco-innovation, policymakers can offer support and resources to firms looking to expand internationally through eco-innovation. Fourth, recognizing the importance of organizational green competencies, policymakers can invest in educational and training programs to build the knowledge and skills necessary for eco-innovation. By offering training and development opportunities, they can help firms become more competitive in green transformation.

Limitations

Although this dissertation adhered to the stringent principles of the positivist case study research approach to ensure validity and reliability by following well-defined and rigorous methodological guidelines (as outlined in the Second Chapter), several limitations should be acknowledged. First, the case study approach does not allow to generalize the findings of qualitative research to the population. The reliability of the proposed decision-support framework was tested in the context of the Lithuanian furniture industry. Consequently, the findings may not be entirely generalizable to an entire industry or other industries or countries, for that matter. However, the decision-support framework serves as a platform for future research and possible applications in other industries. Second, another limitation is related to the first limitation and is the sample size included in this study. Although the inclusion of additional cases in this study may have provided additional insight into the phenomenon under study, it was limited by the total number of medium-sized

manufacturing companies that meet the eligibility criteria, drastically limiting the possibility of including additional cases. Although the research provides valuable insights into the specific cases examined, it might not capture the full spectrum of eco-innovation strategies adopted by medium-sized manufacturing firms. Third, the primary data collection for qualitative research relies on semi-structured interviews with decision-makers. Although this approach provides in-depth qualitative insights, it can introduce potential bias or limitations, such as data saturation. Fourth, the proposed decision-support framework employs MCDM methods to evaluate and rank eco-innovation strategies, and MCDM often relies on the input of decision-making groups and industry experts. The study recognizes the importance of these inputs, but it should be noted that expert opinions can vary, and the composition of decision-making groups can affect the results. The results are influenced by the specific criteria chosen for the analysis and the weight assigned to each criterion. Different criteria or weightings could lead to different rankings. Moreover, the potential challenges of expert availability and biases should be considered. Finally, another limitation is considered from the perspective of MCDM methods. Although BWM–TOPSIS are relatively new and has not been extensively utilized in various strategy selection studies, it does not consider the interdependence between criteria and sub-criteria. Despite these limitations, the study's findings provide valuable insight into the complex study field.

Agenda for Future Research

The agenda for future research emerges from the limitations of this and the continuously evolving nature of the field, along with the specific particularities of eco-innovation strategies in the development of internationalization. First, in future research, the decision-support framework should be applied to medium-sized manufacturing companies in other industries. Conducting comparative studies between different industries or countries can shed light on the particularities of eco-innovation strategies that are within the specific country or industry. However, it is imperative to emphasize that eco-innovation strategy typologies encompass a wide range of strategic green transformations involving both products and processes within an organization. Consequently, to successfully utilize the decision-support framework, the company must possess the capacity to implement changes in both processes and products. Hence, researchers should consider this aspect when applying the framework to other industries. Second, this study highlights the novelty of eco-innovation strategies in the development of internationalization. While the current study emphasizes qualitative research and the application of MCDM methods, future research should consider the introduction of quantitative analyses to provide a statistical perspective on eco-innovation strategies in international development to gain a competitive advantage. Future research could

consider structural equation modeling (SEM) to investigate structural relations among different types of eco-innovations outlined in this dissertation and different internationalization performance measures. Third, to address the limitations of applied MCDM methods, which do not take into consideration the interdependence between criteria and sub-criteria, future studies could address this limitation by applying other MCDM, such as the analytic network process (ANP).

The emerging field of "green internationalization" necessitates investigating the eco-innovation strategies in the subsequent phases of internationalization. As internationalization is a multi-phased process, examining eco-innovation strategies in the different stages of international expansion allows for a more comprehensive understanding of how firms evolve in their green strategies. First, in the pre-internationalization phase, since this dissertation emphasizes the gradual internationalization process through exports, future researchers should investigate the different choices of market entry mode and eco-innovation strategy selection. Second, future research can focus on how firms adapt and modify their eco-innovation strategies as they establish a stronger presence in international markets, moreover, how knowledge transfer within the firm or between the firm and external partners influences eco-innovation strategies as the company becomes more established in the international market. In addition, future research should explore the impact of forming partnerships and alliances and how collaborative efforts shape eco-innovation strategies as well as the integration of eco-innovation strategies into global value chains. This aspect is especially important with the rapid increase of green global value chains. Third, future research should explore how firms embrace circular economy principles and implement closed-loop systems to enhance their eco-innovation strategies while maintaining their global presence.

By structuring future research around these phases of internationalization, it might be possible to gain a more nuanced understanding of how eco-innovation strategies evolve and contribute to a firm's competitive advantage in international business. Such research can inform businesses, policymakers, and scholars in their efforts to promote sustainability and green practices in the global arena.

3.5. Conclusions of the Third Chapter

1. The pilot study conducted as part of this research played a pivotal role in the development of the decision-support framework and provided an opportunity to test and enhance the methodology and data collection tools. The insights and feedback gathered from industry experts contributed significantly to the framework's development and application to real-world cases.

2. The application of the decision-support framework in three real-world internationalization cases has shed light on the complexity of selecting the best eco-innovation strategy. It has become evident that the final choice of strategy is highly dependent on the unique characteristics and circumstances of each company.
3. The evaluation of factors that impact the strategic decision has highlighted the predominant role of the meso-environment. While the micro-environment plays a crucial role in decision-making, the macro-environment appears to have limited significance in the selection of eco-innovation strategy. Factors like public financial support and environmental regulations were assigned relatively low weights, emphasizing their low influence on strategic decision-making in this context.
4. The application of sensitivity analysis in this study served as a valuable tool to test the robustness of the decision-support framework by systematically altering the criteria weights through three different scenarios and allowing the evaluation of the stability and reliability of the eco-innovation strategy ranking.
5. The qualitative research of this study provided valuable insights into the decision-making processes related to the selection of eco-innovation strategies. One of the central findings is that companies might recognize the implementation of eco-innovation and the development of internationalization as two separate strategies not necessarily related to each other on a conscious and integral strategic decision-making level. Rather, companies often perceive eco-innovation as a distinct strategy focused on addressing specific economic challenges, such as increasing production capacity and cost-saving.

General Conclusions

1. The analysis of scientific literature has revealed a lack of consensus regarding the theoretical framework for eco-innovation strategy, and the general nature of eco-innovation strategy is complex and unclear. The existing literature predominantly approaches eco-innovation as isolated practices and solitary solutions with a non-strategic focus. However, empirical studies exploring eco-innovation as a holistic strategy are fragmented. The concept of eco-innovation strategy often overlaps with the environmental strategy of companies and fails to address the ambidextrous nature of eco-innovation. To bridge this existing research gap, the dissertation proposes a novel concept of eco-innovation strategy, emphasizing that the eco-innovation strategy integrates the strategic decisions of a company that are based on continuous improvement and strategic green transformation through the implementation of a set of eco-innovations to enhance the performance of the company in its external environments.
2. The dissertation proposes the classification of four mutually exclusive and collectively exhaustive types of eco-innovation strategy based on generic competitive strategies (cost leadership and differentiation) and benefits that derive from distinct eco-innovation. The proposed strategy classification not only helps the business company to solve the strategic decision problem arising from the trade-off between economic and environmental dimensions but also

emphasizes the competitive advantage in international markets gained through a set of eco-innovations.

3. Considering that in the scientific literature, the eco-innovation strategies in the context of internationalization are relatively new phenomena and have not been explored in depth, in this dissertation, the need to study the interrelationships between eco-innovation and internationalization is justified. Moreover, it has been reasoned that the drivers of eco-innovation differ from factors considered in the strategic decision-making process. Thus, this dissertation proposes a multilevel framework (micro, meso, macro) and classifies the factors that impact the selection of eco-innovation strategy in the pre-internationalization phase.
4. The scientific literature has revealed that extensive research has been conducted on the internationalization process and the company's behavior and decision-making within that process, but the phase prior to internationalization has not received enough attention. It should be noted that strategic decisions made in the pre-internationalization phase shape the future perspective of the company's growth in international markets. Therefore, a theoretical framework for the selection of eco-innovation strategy in the pre-internationalization phase was proposed, integrating suggested eco-innovation strategy alternatives and eco-innovation strategy selection impacting factors.
5. A mixed inquiry strategy integrating a combination of qualitative and quantitative methods was applied to investigate the selection of an eco-innovation strategy in the pre-internationalization phase. A combination of integrated methods enables a systematic assessment of three-level factors impacting the selection of eco-innovation strategy in the pre-internationalization phase. The combination of selected methods allows for the flexible inclusion of factor groups and factors based on the specific environment of the furniture manufacturing company.
6. The results of the empirical study justify the application of the decision-support framework in the context of furniture industry companies. The proposed decision-support framework application methodology was empirically justified in the case of three medium-sized Lithuanian furniture industry manufacturing companies that are in the pre-internationalization phase. It can be argued that the decision-support framework can be used as a support measure for decision-makers of manufacturing companies in the furniture industry to rationally select the best eco-innovation strategy in the pre-internationalization phase. It should be noted that the decision-support framework requires the application to take place in the context of internationalization, and it is necessary to consider other strategic decisions that are made in the pre-internationalization phase.

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Šūmakaris, P., Kovaitė, K., & Korsakienė, R. (2023). An integrated approach to evaluating eco-innovation strategies from the perspective of strategic green transformation: A case of the Lithuanian furniture industry. *Sustainability*, *15*(11), 1–33. https://doi.org/10.3390/su15118971

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Šūmakaris, P., & Korsakienė, R. (2022). Participation of Manufacturing Firms in Global Value Chains and Eco-Innovation Performance: A Case of Lithuania. In *Scientific Conference on Economics and Entrepreneurship Proceedings, SCEE`2022* (pp. 110–121). https://doi.org/10.7250/scee.2022.011

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Summary in Lithuanian

Įvadas

Problemos formulavimas

Empiriniai tyrimai patvirtina internacionalizacijos ir ekoinovacijų svarbą verslo įmonių veiklos rezultatams. Tačiau, iki šiol apie šias sąsajas dar labai mažai žinoma (Galbreath et al., 2021; Martínez-Ros & Merino, 2023). Be to, nors ir daugėja mokslinių tyrimų, susijusių su ekoinovacijomis, akivaizdžiai trūksta mokslinių tyrimų, kuriuose pateikiamas visapusiškas ekoinovacijų strategijos koncepcijos supratimas (Shukla, 2019; López Pérez et al., 2023). Dabartinės ekoinovacijų strategijos koncepcijos yra fragmentiškos ir gana ribotos, jos dažnai tapatinamos su organizacijos aplinkosaugos strategija ir neapima plataus strateginio požiūrio į ekoinovacijas (Luan et al., 2023; Sun & Sun, 2021).

Daugumoje tyrimų ekoinovacijos nagrinėjamos kaip pavienės ir izoliuotos verslo praktikos, neatsižvelgiant į strateginę verslo įmonės perspektyvą, ir trūksta mokslinių tyrimų, kuriuose reiškinys būtų nagrinėjamas iš organizacijos valdymo ir strateginių sprendimų priėmimo perspektyvų (López Pérez et al., 2023; Tamayo-Orbegozo et al., 2017). Ekoinovacijų vertinimas ne iš strateginės perspektyvos gali turėti verslo įmonėms ilgalaikių neigiamų pasekmių, pavyzdžiui, neveiksmingas išteklių panaudojimas izoliuotoms, nesuderintoms tarpusavyje ir pavienėms ekoinovacijoms, dėl to prarandami klientai bei mažėja organizacijos konkurencinis pranašumas (Wijethilake et al., 2018). Tačiau strateginių sprendimų priėmimo procesas, susijęs su ekoinovacijomis, yra sudėtingas ir verslo įmonės

yra labiau linkusios teikti pirmenybę strateginėms investicijoms į ekoinovacijas, kai yra garantuotos, kad ekoinovacijos pagerins įmonės veiklos rezultatus (Chappin et al., 2020).

Todėl problema kyla, kai siekdamos rasti kompromisą tarp ekonominių ir aplinkosauginių įmonės rezultatų įmonės privalo priimti sudėtingą strateginį sprendimą ir yra priverstos derinti ekonominius ir aplinkos apsaugos aspektus. Tačiau, mokslinėje literatūroje ekoinovacijų strategijos, plėtojant įmonės internacionalizaciją koncepcija, yra santykinai naujas reiškinys ir iki šiol nebuvo atlikta empirinių tyrimų, kuriuose būtų nagrinėjamas strateginių sprendimų priėmimo procesas, susijęs su ekoinovacijomis, įmonės pasiruošimo internacionalizacijai etape. Taigi dėl reiškinio naujumo ir sudėtingumo bei ribotų žinių sudėtinga vertinti ekoinovacijų strategiją kaip vieną iš pagrindinių įmonės internacionalizacijos strategijos dedamųjų.

Darbo aktualumas

Pastaraisiais metais pasauliniu mastu išaugo susirūpinimas spartaus ekonominio vystymosi poveikiu gamtai (Zhang et al., 2022). Reaguodamos į aplinkosaugos iššūkius, daugelis Ekonominio bendradarbiavimo ir plėtros organizacijos (EBPO) šalių pripažino ekoinovacijų svarbą (Ullah et al., 2022). Europos Sąjunga (ES) aktyviai skatina inovacijas, nukreiptas į ekologišką praktiką, (EIO, 2019) ir įgyvendina svarbias investicijų programas, tokias kaip „Europos žaliasis kursas“ ir „Europos horizontas“. Be to, pastarojo meto geopolitinės, ekonominės ir socialinės bei aplinkosaugos krizės paspartino vykstančią žaliąją pramonės transformaciją (ETTG, 2022), kuri yra daugialypis technologinis ir socioekonominis procesas, glaudžiai susijęs su ekoinovacijomis (Inovacijų agentūra, 2023).

Be pasaulinio aplinkosaugos reglamentavimo ir tvaraus vystymosi siekio, tiek sparti globalizacija, tiek auganti vartotojų paklausa ekologiškiems produktams ir procesams, vis labiau skatina verslo įmones pasirinkti ekologiškas strategijas (Qing et al., 2022). Tokie vyriausybės stūmimo ir rinkos traukos veiksniai atvėrė horizontus kurtis naujoms konkuravimo taisyklėms (Huang & Li, 2018; Zameer et al., 2022).

Taigi aplinkosaugos politika ir paskatos įprastai formuojamos makrolygmeniu, rinkos dinamika siejama su mezolygmeniu, tačiau ekoinovacijų įgyvendinimas vyksta verslo įmonėje – mikrolygmeniu (Allacker et al., 2019). Todėl norint pasiekti sisteminę žaliąją pramonės transformaciją, pokyčiai turi vykti verslo įmonės lygmeniu. Tačiau verslo įmonės pirmiausia turi suprasti ekoinovacijų naudą ir turėti tinkamas priemones, kurios padėtų įgyvendinti žaliąją transformaciją pasiekiant kompromisą tarp ekonominių ir aplinkosaugos aspektų ir nekeliant grėsmės įmonės rezultatams.

Tyrimo objektas

Darbo tyrimo objektas – ekoinovacijų strategijos internacionalizacijos kontekste.

Darbo tikslas

Šio darbo tikslas – pagrįsti sprendimų priėmimo paramos modelį, skirtą racionaliam ekoinovacijų strategijos parinkimui internacionalizacijos kontekste.

Darbo uždaviniai

1. Konceptualizuoti ekoinovacijas, ekoinovacijų tipus ir ekoinovacijų diegimą bei įmonių ekoinovacijų strategijas, identifikuojant pagrindines charakteristikas strateginės žaliosios transformacijos ir konkurencinio pranašumo tarptautinėse rinkose požiūriu.
2. Pagrįsti strateginių sprendimų priėmimo požiūrio taikymą ekoinovacijų strategijos parinkimui pasiruošimo internacionalizacijai etape, identifikuojant verslo strateginius gebėjimus, išteklius ir išorinės aplinkos veiksnius.
3. Pagrįsti teorinę ekoinovacijų strategijos parinkimo pasiruošimo internacionalizacijai etape sistemą, integruojant siūlomas ekoinovacijų strategijų alternatyvas ir veiksnius, veikiančius ekoinovacijų strategijos parinkimą.
4. Apibrėžti filosofines tyrimų prielaidas ir metodologiją, tiriant ekoinovacijų strategijos parinkimą pasiruošimo internacionalizacijai etape atvejus.
5. Empiriškai pagrįsti siūlomą sprendimų priėmimo paramos modelį, skirtą racionaliam ekoinovacijų strategijos parinkimui pasiruošimo internacionalizacijai etape, ir gauti įžvalgas apie strateginių sprendimų priėmimo procesą ir jo rezultatus.

Tyrimų metodika

Šioje disertacijoje taikytas kelių atvejų analizės tyrimas, grįstas pozityvistine filosofine paradigma, ir kokybinių bei kiekybinių metodų derinys kaip empirinių tyrimų strategija. Pirmas skyrius skirtas pristatyti teoriniam ekoinovacijų strategijų pagrindui, plėtojant internacionalizaciją, todėl mokslinės literatūros analizei buvo naudojami įvairūs metodai, tokie kaip mokslinės literatūros sintezė ir loginė, sisteminė bei lyginamoji analizė. Antras skyrius skirtas racionalaus ekoinovacijų strategijų parinkimo pasiruošimo internacionalizacijai etape metodologijai. Buvo parengta empirinė tyrimų metodika su tyrimo instrumentais ir išbandyta atliekant bandomąjį tyrimą kartu su Lietuvos baldų pramonės ekspertais. Siekiant parengti ir empiriškai patvirtinti sprendimų priėmimo paramos modelį, buvo pritaikytas daugiakriterinių vertinimo metodų (toliau – DVM) derinys: *Delfi* metodas, analitinio hierarchinio proceso metodas (AHP), geriausias blogiausias metodas (BWM), prioriteto nustatymo pagal artumo idealiajam taškui kriterijų metodas (TOPSIS) ir jautrumo analizė. Siūlomas sprendimų priėmimo paramos modelis buvo pritaikytas trijose vidutinio dydžio Lietuvos baldų pramonės gamybos įmonėse, kurios yra pasiruošimo internacionalizacijai etape. Tuo pačiu metu buvo atliktas kokybinis tyrimas, o duomenys buvo renkami parengus klausimyną, kuris buvo naudojamas pusiau struktūruotose interviu. Surinkti duomenys buvo analizuojami taikant kokybinės turinio analizės metodą. Trečiame skyriuje pateikiama empirinių tyrimų rezultatų analizė.

Darbo mokslinis naujumas

Rengiant disertaciją buvo pasiekti reikšmingi rezultatai vadybos mokslo krypčiai:

1. Inovacijų valdymo žinios papildytos nauja ekoinovacijų strategijos koncepcija, kuri, priešingai nei tradicinis požiūris, dėmesį sutelkia į ekoinovacijų rinkinio pasirinkimą, integruojamą įmonės lygmeniu ir nukreiptą į konkrečią strateginę žaliąją produktų ar procesų transformaciją, taip užtikrinant sisteminį pokytį įmonės lygmeniu.
2. Strateginio valdymo žinios papildytos nauju požiūriu į strateginių sprendimų priėmimą ir ekoinovacijų strategijos pasirinkimą pasiruošimo internacionalizacijai etape, identifikuojant verslo strateginius gebėjimus, išteklius bei išorinės aplinkos veiksnius, ir nauja ekoinovacijų strategijos alternatyvų klasifikacija, pagrįsta verslo įmonės konkurencine orientacija, sprendžiant ekonominių ir aplinkosaugos aspektų kompromisą.
3. Internacionalizacijos žinios papildytos struktūrizuotu ir išsamiu požiūriu į ekoinovacijų ir internacionalizacijos sąsają, integruojant ekoinovacijų strategijos parinkimą pasiruošimo internacionalizacijai etape ir taip prisidedant prie besiformuojančios naujos tyrimų srities – žaliosios internacionalizacijos bei metant iššūkį tradicinėms internacionalizacijos teorijoms ir moksliniams požiūriams į tarptautinį verslo vystymą, kuriuose neatsižvelgiama į esminį pasiruošimo internacionalizacijai etapą.
4. Disertacijos metodologiniu naujumu laikytinas kelių atvejų analizės tyrimas grįstas pozityvistine filosofine paradigma ir originaliu kokybinių ir kiekybinių metodų deriniu kaip empirinių tyrimų strategija, tiriant ekoinovacijų strategijas internacionalizacijos kontekste.
5. Empiriškai patikrintas sprendimų priėmimo paramos modelis integruoja pagrindines strateginio valdymo, inovacijų valdymo ir internacionalizacijos teorijas ir modelius ir suteikia sistemišką ir visapusišką požiūrį, analizuojant ir vertinant sprendimų priėmimą lemiančius mikro-, mezo- ir makrolygmens veiksnius, susijusius su racionaliu ekoinovacijų strategijos parinkimu baldų gamybos įmonės pasiruošimo internacionalizacijai etape.

Darbo rezultatų praktinė reikšmė

1. Pasiūlytas sprendimų priėmimo paramos modelis, skirtas sprendimus priimantiems asmenims, leidžia pasirinkti geriausią ekoinovacijų strategiją įmonės pasiruošimo internacionalizacijai etape, naujose tarptautinėse rinkose įgyvendinant strateginę žaliąją įmonės produktų ar procesų transformaciją.
2. Siūlomas sprendimų priėmimo paramos modelis, skirtas racionaliam ekoinovacijų strategijos parinkimui įmonės pasiruošimo internacionalizacijai etape, orientuotas į baldų gamybos įmones, kurios susiduria su konkurencingos ekoinovacijų strategijos parinkimo problema, siekdamos patekti į užsienio rinką, prisitaikyti prie sparčiai kintančių globalių sąlygų ir aplinkosaugos reikalavimų, veiksmingai naudoti ribotus išteklius ir sutelkti dėmesį į konkrečią strateginės žaliosios transformacijos sritį.

3. Darbo rezultatai naudingi sprendimų priėmėjams, politikos formuotojams ir vyriausybinėms institucijoms, atsakingoms už ekoinovacijas ir internacionalizacijos politiką bei paramos priemones. Taip prisidedama prie Europos žaliojo kurso strategijos, kuria siekiama, kad Europa iki 2050 m. taptų pirmuoju pasaulyje neutralaus poveikio klimatui žemynu, ir kitų ES iniciatyvų įgyvendinimo.

Ginamieji teiginiai

1. Šiuolaikinės verslo praktikos kontekste konkurencinio pranašumo tarptautinėse rinkose didinimas ir perėjimas prie neutralų poveikį klimatui turinčios gamybos reikalauja sisteminio ir holistinio požiūrio, sprendžiant ekonominių ir aplinkosaugos aspektų kompromisą, o ne pavienių ekoinovacijų diegimo, todėl disertacijoje siūloma nauja ekoinovacijų strategijos koncepcija ir skirtingų strategijos tipų klasifikacija.
2. Tarptautinė šiuolaikinių baldų gamybos įmonių plėtra reikalauja, kad ekoinovacijų strategija būtų vertinama kaip integrali įmonės internacionalizacijos strategijos dedamoji, o internacionalizacijos ir ekoinovacijų sąsajos klausimas disertacijoje atskleidžiamas pasiūlant sistemą, integruojančią strateginius sprendimus, susijusius su ekoinovacijų strategijos parinkimu, į strateginių sprendimų rinkinį pasiruošimo internacionalizacijai etape.
3. Empiriškai patvirtinta sistemiško sprendimų priėmimą lemiančių mikro-, mezo- ir makrolygmens veiksnių vertinimo metodologija gali būti taikoma strateginių sprendimų priėmimo procese racionaliam ekoinovacijų strategijos parinkimui baldų gamybos įmonės pasiruošimo internacionalizacijai etape.

Darbo rezultatų aprobavimas

Disertacijos tema paskelbti šie moksliniai straipsniai: 3 straipsniai recenzuojamuose tarptautiniuose mokslo žurnaluose, kurie yra indeksuojami *Web of Science* ir *Scopus* duomenų bazėse (Šūmakaris et al., 2020; 2021; 2023); 2 straipsniai tarptautinių konferencijų straipsnių rinkiniuose (Šūmakaris & Korsakienė, 2021; 2022). Disertacijos tema skaityti keturi pranešimai tarptautinėse mokslo konferencijose:

- 11-oji tarptautinė mokslinė konferencija „Contemporary issues in business, management and economics engineering“, 2021 m. gegužės 13 d., Vilnius, Lietuva;
- 12-oji tarptautinė mokslinė konferencija „Business and Management“, 2022 m. gegužės 12 d., Vilnius, Lietuva;
- 63-oji tarptautinė mokslinė konferencija „Scientific Conference on Economics and Entrepreneurship“, 2022 spalio 13 d., Ryga, Latvija;
- 13-oji tarptautinė mokslinė konferencija „Business and Management“, 2023 m. gegužės 11 d., Vilnius, Lietuva.

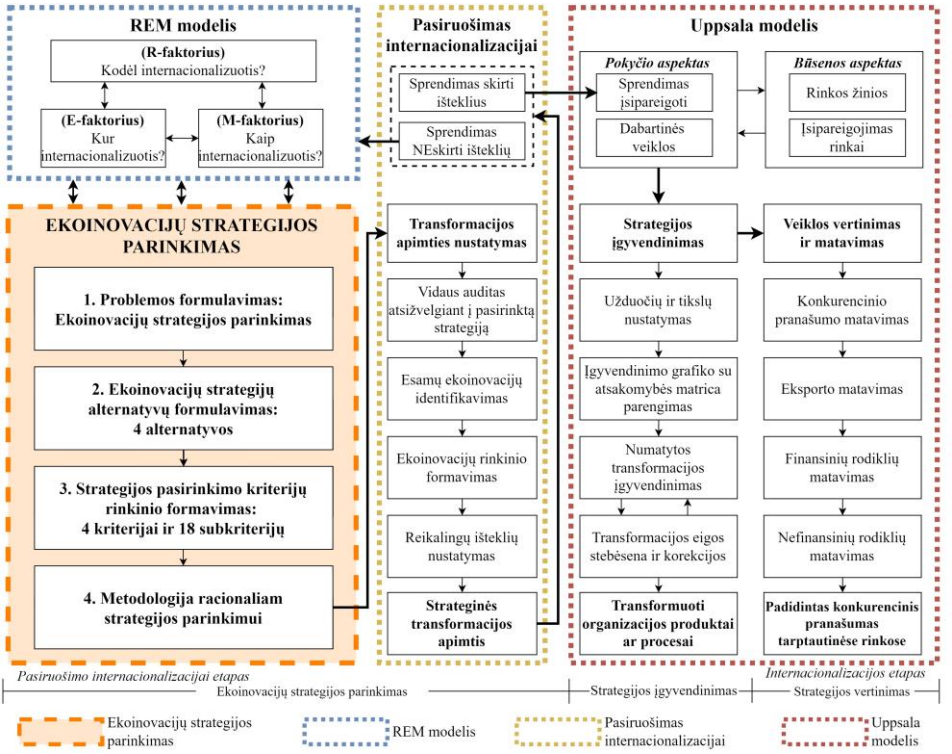
Galutiniai disertacijos tyrimų rezultatai buvo pristatyti moksliniame seminare 2023 spalio 12 d. Rygos technikos universitete (*Riga Technical University*), Ryga, Latvija.

Disertacijos struktūra

Darbą sudaro įvadas, trys dalys, bendrosios išvados, literatūros sąrašas, autoriaus publikacijų disertacijos tema sąrašas ir 6 priedai (A, B, C, D, E). Disertacijos apimtis – 134 puslapiai be literatūros sąrašo ir priedų. Disertacijoje yra 28 paveikslai, 51 lentelė, pateikiami 254 literatūros šaltiniai.

1. Ekoinovacijų strategijų plėtojant internacionalizaciją teorinis kontekstas

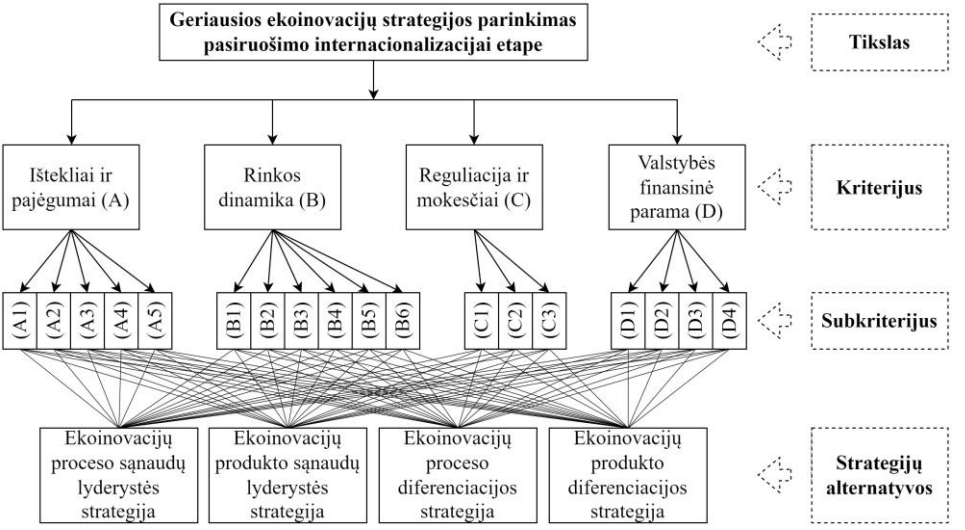
Pirmame disertacijos skyriuje pateiktas ekoinovacijų strategijų plėtojant internacionalizaciją teorinis kontekstas. Atlikta literatūros analizė atskleidė, kad trūksta sprendimų priėmimo paramos modelio, susijusio su ekoinovacijų strategijos parinkimu verslo įmonės internacionalizacijos kontekste, todėl konstatuota, kad yra reikalingi tolesni empiriniai tyrimai. S1.1 pav. pateikiama teorinė ekoinovacijų strategijos parinkimo įmonės pasiruošimo internacionalizacijai etape sistema ir šios disertacijos mokslinių tyrimų laukas.



S1.1 pav. Teorinė ekoinovacijų strategijos parinkimo įmonės pasiruošimo internacionalizacijai etape sistema (šaltinis: sudaryta autoriaus)

Teorinė sistema sukurta remiantis pagrindinėmis strateginio valdymo, inovacijų valdymo, sprendimų priėmimo bei internacionalizacijos teorijomis ir koncepcijomis. Strateginių sprendimų hierarchijoje ekoinovacijų strategija yra parenkama įmonės pasiruošimo internacionalizacijai etape po pirminio sprendimo internacionalizuotis, naujos užsienio rinkos ir tradicinio patekimo į užsienio rinką strategijos pasirinkimo.

S1.2 pav. pateikiama sprendimo problemos parenkant ekoinovacijų strategiją hierarchinė struktūra. Sprendimo problemos hierarchinės struktūros pateikimu, siekiama kiekybiškai įvertinti santykinius sprendimų priėmimo kriterijus, parenkant geriausią ekoinovacijų strategijos alternatyvą (Kahraman et al., 2015). Todėl teorinė sistema ir sprendimo problemos hierarchinė struktūra yra šios disertacijos empirinės dalies, kurioje atliekami tolesni empiriniai tyrimai, pagrindas.



S1.2 pav. Sprendimo problemos parenkant ekoinovacijų strategiją hierarchinė struktūra (šaltinis: sudaryta autoriaus)

Atlikus mokslinės literatūros analizę, daromos šios išvados:

1. Išanalizavus mokslinę literatūrą, kurioje nagrinėjami probleminiai ir teoriniai ekoinovacijų strategijų plėtojant internacionalizaciją aspektai, buvo pagrįstas disertacijos aktualumas bei konstatuota būtinybė pildyti mokslinių žinių spragą ir plėtoti mokslinius tyrimus šioje palyginti mažai tyrinėtoje srityje.
2. Mokslinėje literatūroje pastebima spraga, susijusi su visapusišku ekoinovacijų strategijos koncepcijos supratimu. Moksliniai tyrimai daugiausia nagrinėja ekoinovacijas kaip pavienes organizacijos praktikas, tad pasigendama strateginio požiūrio. Ekoinovacijų strategijų samprata dar nėra išplėtota, nėra vieningos mokslininkų nuomonės, o šios srities moksliniai tyrimai yra fragmentiški ir neapima įvairių ekoinovacijų aspektų.

3. Išnagrinėjus skirtingus ekoinovacijų tipus, identifikuoti įvairūs ekoinovacijų tipų klasifikavimo būdai, tačiau, siekiant pagrįsti ekoinovacijų strategijos koncepcijos pranašumą, palyginti su pavieniais ekoinovacijų sprendimais, šioje disertacijoje buvo pasiūlyta nauja ekoinovacijų strategijos koncepcija ir keturių skirtingų ir tarpusavyje nesąveikaujančių ekoinovacijų strategijos tipų klasifikacija, pagrįsta klasikinėmis konkuravimo strategijomis (išlaidų lyderystė ir diferencijacija) ir nauda, gaunama iš skirtingų ekoinovacijų.
4. Mokslinėje literatūroje ekoinovacijų strategijų, plėtojant įmonės internacionalizaciją, koncepcija yra santykinai naujas ir netyrinėtas reiškinys, dėl to nėra mokslinių tyrimų, kuriuose būtų klasifikuoti ekoinovacijų strategijos parinkimui poveikį darantys veiksniai, bet yra ganėtinai daug mokslinių tyrimų, kuriuose nagrinėjami ekoinovacijas skatinantys veiksniai. Matyti, kad ekoinovacijas skatinantys veiksniai skiriasi nuo veiksnių, kuriuos reikia vertinti priimant strateginius sprendimus, todėl disertacijoje siūloma trijų lygmenų (mikro-, mezo- ir makro-) veiksnių, veikiančių ekoinovacijų strategijos parinkimą pasiruošimo internacionalizacijai etape, sistema.
5. Mokslinės literatūros analizė atskleidė, kad strateginiai sprendimai, priimti pasiruošimo internacionalizacijai etape formuoja tolesnę įmonės augimo tarptautinėse rinkose perspektyvą, todėl siekiant sėkmingai konkuruoti tarptautinėse rinkose būtina integruoti ekoinovacijas į bendrą įmonės internacionalizacijos strategiją, o ekoinovacijų strategij turėtų būti pasirenkama pasiruošimo internacionalizacijai etape.
6. Mokslinės literatūros analizė atskleidė, kad trūksta sprendimų priėmimo paramos modelio, susijusio su ekoinovacijų strategijos parinkimu verslo įmonės internacionalizacijos kontekste, todėl pasiūlyta teorinė ekoinovacijų strategijos parinkimo pasiruošimo internacionalizacijai etape sistema ir sprendimo problemos parenkant ekoinovacijų strategiją hierarchinė struktūra, kuri yra tolesnių empirinių tyrimų atskaitos taškas.
7. Konstatuota, kad disertacijos įvado dalyje suformuluoti uždaviniai tikslinimo nereikalauja.

2. Empirinio tyrimo metodologija racionaliam ekoinovacijų strategijos parinkimui pasiruošimo internacionalizacijai etape

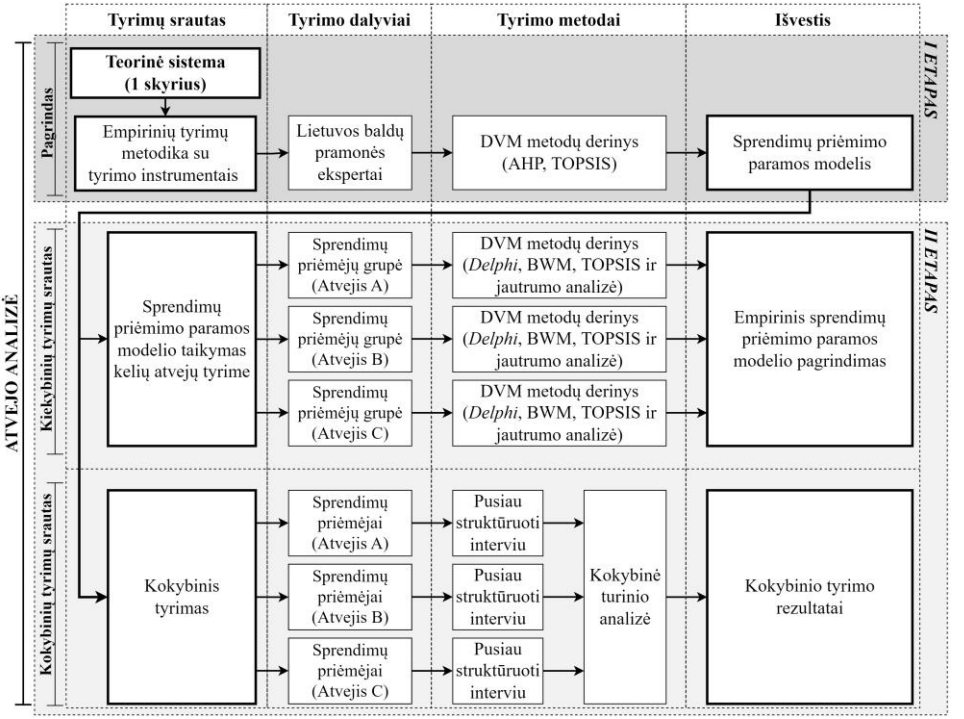
Antrame skyriuje pateikiamos filosofinės tyrimų prielaidos ir metodologija, taikoma tiriant ekoinovacijų strategijos parinkimą pasiruošimo internacionalizacijai etape atvejus. Pateikiama tyrimo eiga, kontekstas, informacija apie tyrimo dalyvius bei detalus tyrimo protokolas, apimantis tyrimo metodų parinkimą, pagrindimą ir metodų taikymo ypatumus. Skyriuje pristatomas sprendimo priėmimo paramos modelis, skirtas racionaliai parinkti ekoinovacijų strategiją įmonės pasiruošimo internacionalizacijai etape, bei pristatomi modelio kūrimo ypatumai, bandomasis tyrimas ir praktinis sukurto modelio taikymas. Atsižvelgiant į šios disertacijos tikslą, probleminius ir teorinius aspektus, šioje disertacijoje taikyta kelių atvejų tyrimo analizė, pagrįsta pozityvistine filosofine paradigma kaip empirinių tyrimų strategija, derinant kokybinius ir kiekybinius tyrimų metodus. Empirinę disertacijos tyrimo dalį sudaro du etapai ir trys empirinių tyrimų srautai (S2.1 paveikslas).

I etapas. Pirmajame etape, remiantis pirmame skyriuje pateikta teorine sistema ir hierarchine sprendimo problemos struktūra, buvo sukurta empirinė tyrimų metodika su duomenų rinkimo instrumentais ir išbandyta atliekant bandomąjį tyrimą kartu su Lietuvos baldų pramonės ekspertais. Vėliau buvo pasiūlytas sprendimų priėmimo paramos modelis. Po bandomojo tyrimo iškilo poreikis atlikti išsamesnį ir kokybinį tyrimą, kuris leistų ištirti strateginių sprendimų priėmimo procesą, susijusį su ekoinovacijų strategijos parinkimu įmonės pasiruošimo internacionalizacijai etape.

II etapas. Antrąjį etapą sudaro du empirinių tyrimų srautai. Buvo taikoma mišrių tyrimų metodologija, kurioje derinami kokybiniai ir kiekybiniai tyrimų metodai, remiantis autorių pateiktomis gairėmis (Rashid et al., 2019; Yin, 2014).

Kiekybinių tyrimų srautas. Šis mokslinių tyrimų srautas, siekiant empiriškai pagrįsti pasiūlytą sprendimų priėmimo paramos modelį racionaliam ekoinovacijų strategijos parinkimui, buvo pritaikytas 3 baldų pramonės gamybos įmonėse.

Kokybinių tyrimų srautas. Siekiant gauti išsamių įžvalgų, susijusių su strateginių sprendimų priėmimo procesu parenkant ekoinovacijų strategiją verslo įmonių pasiruošimo internacionalizacijai etape, buvo surengti individualūs interviu su sprendimus priimančiais asmenimis iš kiekvienos pasirinktos įmonės, o surinkti duomenys buvo analizuojami taikant kokybinės turinio analizės metodą.



S2.1 pav. Atvejo analizės tyrimo eiga (šaltinis: sudaryta autoriaus)

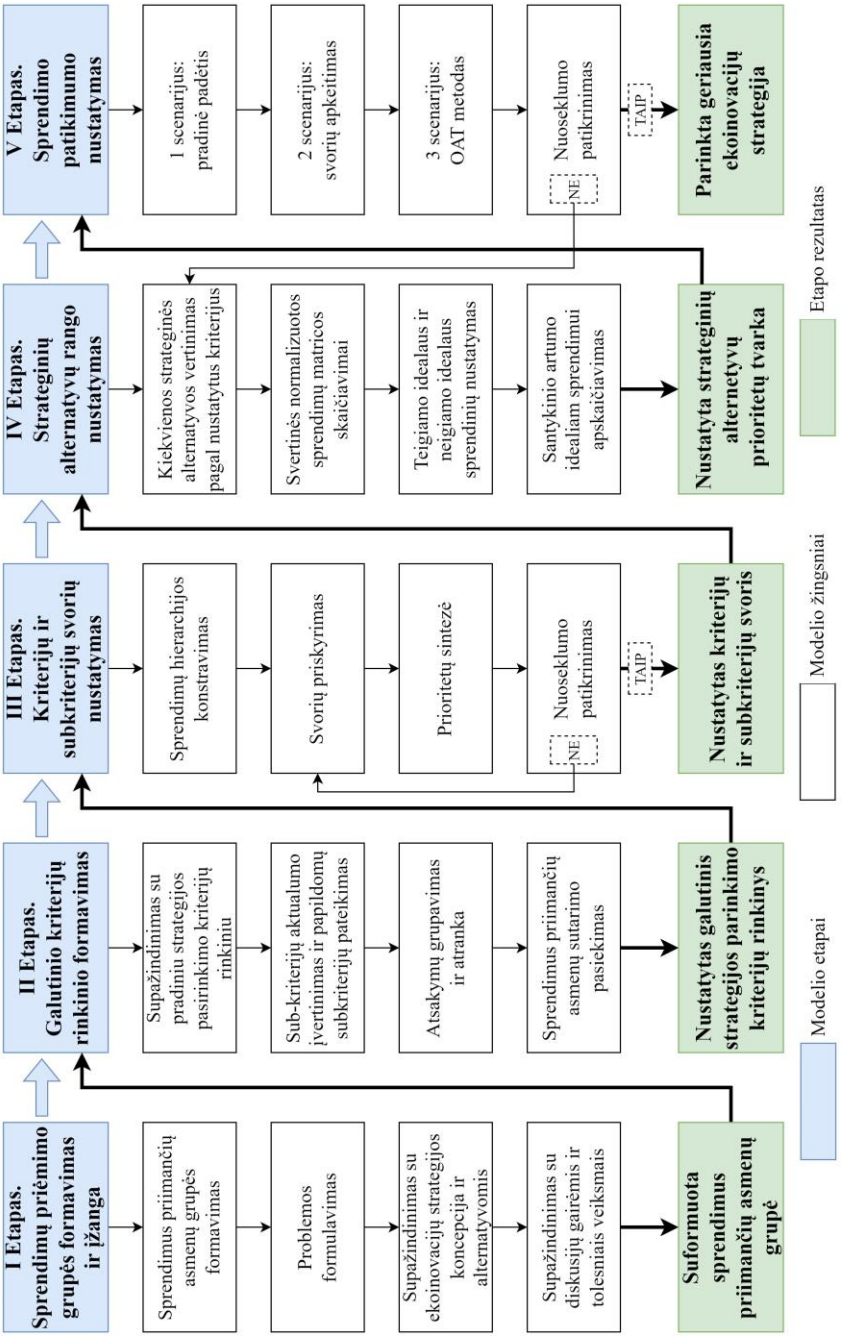
Iškeltas pagrindinis empirinio tyrimo klausimas: kaip sprendimus priimantys asmenys parenka geriausią ekoinovacijų strategiją vidutinio dydžio gamybos įmonėms pasiruošimo internacionalizacijai etape? Pagrindinis tyrimo klausimas buvo išplėtotas į antrinius klausimus, kurie leido išsamiau nagrinėti tyriamą reiškinį.

Šios disertacijos empirinis tyrimas buvo atliktas Lietuvos baldų pramonėje (EVRK C31), o ši pramonė pasirinkta dėl trijų priežasčių. Pirma, šis sektorius yra labai reikšmingas Lietuvos ekonomikai ir ypač eksportui. 2021 metais baldų pramonė (C31) sudarė 7,07 proc. visos lietuviškos kilmės eksporto vertės ir 11,43 proc. visos apdirbamosios pramonės (C) eksporto. Antra, Lietuva šiuo metu atsilieka nuo suplanuotų aplinkosaugos ir klimato politikos tikslų, todėl šio sektoriaus įmonės yra puikios kandidatės siekiant įgyvendinti ekoinovacijų strategiją. Pagal ekoinovacijų indeksą 2022 metais Lietuva tarp 27 ES valstybių narių užėmė tik 23 vietą. Trečia, ankstesnė šios disertacijos autoriaus patirtis verslo praktikoje suteikė prieigą prie pramonės įmonių ir sudarė galimybes apklausti sprendimus priimančius asmenis. Empirinio tyrimo dalyviai skirstomi į keturias grupes. Pirmoji grupė, sudaryta iš pramonės ekspertų, kuri dalyvavo bandomajame tyrime. Likusios trys grupės buvo suformuotos atrenkant iš kiekvienos verslo įmonės sprendimus priimančius asmenis, kurie dalyvavo dviejose tyrimų srautuose.

Bandomasis tyrimas buvo atliktas Lietuvos baldų pramonės kontekste ir paskelbtas mokslinėje publikacijoje (Šūmakaris et al., 2023). Šiuo tyrimu buvo siekiama išbandyti sukurtus duomenų rinkimo instrumentus Buvo stengiamasi užtikrinti, kad klausimynuose nebūtų netinkamų klausimų, būtų aiškūs subkriterijų apibrėžimai ir išsamiai pateikta informacija, instrumentai turėtų aiškius nurodymus, būtų lengvai suprantami ir naudojami. Atlikus bandomąjį tyrimą buvo sukurtas sprendimų priėmimo paramos modelis racionaliam ekoinovacijų strategijos pasirinkimui pasiruošimo internacionalizacijai etape (S2.2 pav.). Siūlomas sprendimų priėmimo paramos modelis grindžiamas pagrindinių strateginio valdymo teorijų ir modelių integracija, mišriu strateginių sprendimų priėmimo procesu ir daugiakriterinių metodų integracija bei ne tik užpildo esamą žinių spragą ir yra teorinis pagrindas bei tolesnių mokslinių tyrimų platforma, bet ir padeda baldų gamybos įmonėse sprendimus priimantiems asmenims realiomis sąlygomis priimti strateginius sprendimus ir parinkti geriausią ekoinovacijų strategiją pasiruošimo internacionalizacijai etape. Siūlomo sprendimų priėmimo paramos modelio pagrindiniai 5 etapai:

1. Problemos formulavimas ir sprendimus priimančių asmenų grupės formavimas.
2. Galutinio kriterijų rinkinio nustatymas.
3. Kriterijų ir subkriterijų svorių nustatymas.
4. Strateginių alternatyvų rango nustatymas.
5. Sprendimo patikimumo nustatymas.

Atsižvelgiant į ribotumą, kylantį dėl vieno DVM taikymo, disertacijoje pasirinkta taikyti daugiapakopį sprendimų priėmimo procesą, apimantį skirtingų DMV derinį, validuotą prieš tai atliktuose tyrimuose (Al Theeb et al., 2022; Gonçalves et al., 2019; Kumar et al., 2020; Ullah et al., 2022; Zavadskas et al., 2017, 2021). Siūlomo sprendimų priėmimo paramos modelio taikymą sudaro du etapai: i) pasirengimo; ii) taikymo. Pasirengimo etapo tikslas – įvertinti ir užtikrinti, kad įmonė, kurioje taikomas sprendimų priėmimo paramos modelis, atitiktų tinkamumo kriterijus. Tikimasi, kad užbaigus visus penkis siūlomo sprendimų priėmimo paramos modelio etapus, bus parinkta geriausia ekoinovacijų strategija pasiruošimo internacionalizacijai etape.



S2.2 pav. Sprendimų priėmimo paramos modelis (šaltinis: sudaryta autoriaus)

3. Empirinis sprendimų priėmimo paramos modelio, skirto racionaliam ekoinovacijų strategijos parinkimui pasiruošimo internacionalizacijai etape, pagrindimas

Trečiame skyriuje pateikiamas empirinis siūlomo sprendimų priėmimo paramos modelio pagrindimas ir gautos įžvalgos apie strateginių sprendimų priėmimo procesą ir jo rezultatus. Taip pat pateikiama bandomojo tyrimo ir praktinio sprendimų priėmimo paramos modelio taikymo kelių atvejų analizės rezultatai. Toliau pateikiami kokybinio tyrimo rezultatai, diskusija, teorinė ir praktinė darbo reikšmė, ribotumai ir tolesnių tyrimų gairės. Siūlomas sprendimų priėmimo paramos modelis buvo pritaikytas trijose vidutinio dydžio Lietuvos baldų pramonės gamybos įmonėse, kurios yra pasiruošimo internacionalizacijai etape.

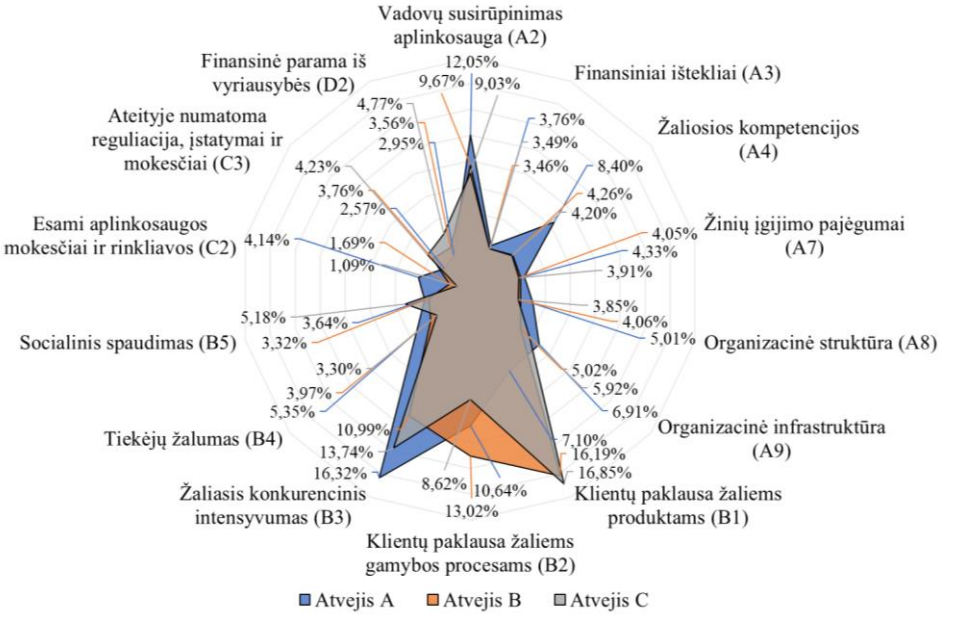
S3.1 lentelė. Apibendrintas kriterijų ir subkriterijų sąrašas (šaltinis: sudaryta autoriaus)

Kriterijus (simbolis)	Subkriterijus (simbolis)	Paaiškinimas	A Atvejis	B Atvejis	C Atvejis
1	2	3	4	5	6
Ištekliai ir gebėjimai (A)	Darbuotojų susirūpinimas aplinkosauga (A1)	Nurodo darbuotojų požiūrį ir susirūpinimą aplinkosaugos problemomis ir spaudimą diegti ekoinovacijas	✓	✓	✓
	Vadovų susirūpinimas aplinkosauga (A2)	Nurodo aukščiausios vadovybės požiūrį į aplinkosaugos problemas ir ekoinovacijų diegimą	✓	✓	✓
	Finansiniai ištekliai (A3)	Nurodo įmonės bendrą finansinę būklę ir finansinius išteklius	✓	✓	✓
	Žaliosios kompetencijos (A4)	Nurodo darbuotojų ir vadovų kompetencijas, susijusias su aplinkosauga ir gebėjimu suprasti, integruoti, valdyti ir panaudoti aplinkosaugos žinias		✓	✓
	Žaliosios pardavimo ir rinkodaros personalo kompetencijos (A5)	Nurodo pardavimų ir rinkodaros darbuotojų kompetencijas, susijusias su aplinkosauga ir gebėjimu suprasti, integruoti, valdyti ir panaudoti aplinkosaugos žinias	✓		
	Žaliosios gamybos personalo kompetencijos (A6)	Nurodo gamybos personalo kompetencijas, susijusias su aplinkosauga ir gebėjimu suprasti, integruoti, valdyti ir panaudoti aplinkosaugos žinias	✓		
	Žinių įgijimo pajėgumai (A7)	Nurodo įmonės gebėjimą identifikuoti ir įgyti išorinių aplinkosaugos žinių ir išorinių partnerių skaičių	✓	✓	✓
	Organizacinė struktūra (A8)	Nurodo nematerialius įmonės elementus (hierarchiją, struktūrą, vidinę komunikaciją ir administracinį aparatą (vidaus politiką ir procedūras, aplinkos apsaugos skyrių skaičių), orientuotus į aplinkos apsaugą	✓	✓	✓
	Organizacinė infrastruktūra (A9)	Nurodo materialius įmonės elementus (įrenginius, įrangą, programinę įrangą, transportą ir ryšių sistemas), skirtus aplinkos apsaugai	✓	✓	✓
	Pardavimo kanalai (A10)	Nurodo pardavimo kanalų skaičių ir tinkamumą perteikti klientams vertę, susijusią su aplinkosauga		✓	

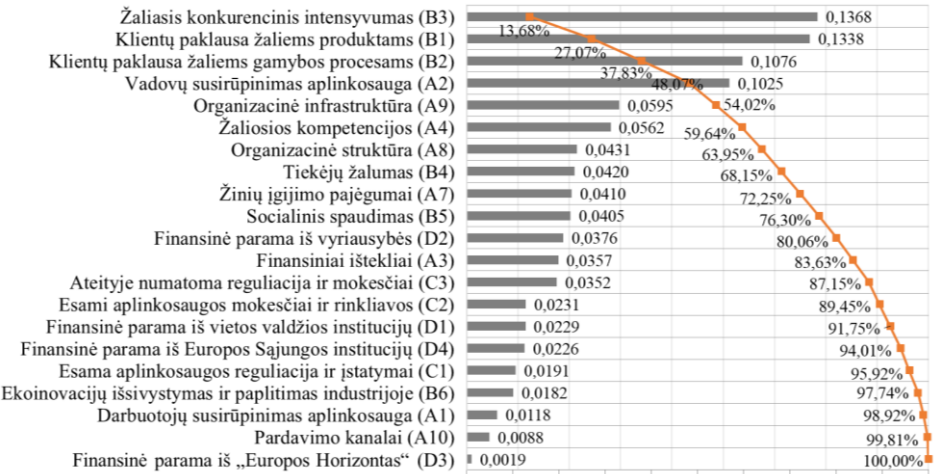
S3.1 lentelės pabaiga

1	2	3	4	5	6
Rinkos dinamika (B)	Klientų paklausa žaliems produktams (B1)	Nurodo klientų ekologiškū produktų poreikį ir atkreipiamą dėmesį į ekologišką produktų koncepciją	✓	✓	✓
	Klientų paklausa žaliems gamybos procesams (B2)	Nurodo klientų poreikį laikytis bendros įmonės aplinkosaugos atsakomybės ir ekologiškų gamybos procesų	✓	✓	✓
	Žaliasis konkurencinis intensyvumas (B3)	Nurodo konkurencijos intensyvumo lygį ir konkurencinį spaudimą, susijusi su aplinkosaugos produktais ir procesais	✓	✓	✓
	Tiekėjų žalumas (B4)	Nurodo esamų tiekėjų ekologinį išsivystymą, žaliųjų tiekėjų skaičių ir tiekėjų koncentraciją rinkoje, siejamas su tiekėjo keitimo išlaidomis	✓	✓	✓
	Socialinis spaudimas (B5)	Nurodo kitas suinteresuotąsias šalis, nevyriausybines organizacijas, aplinkosaugininkus ir socialinį spaudimą, susijusius su aplinkosaugos atsakomybe	✓	✓	✓
	Ekoinovacijų išsivystymas ir paplitimas industrijoje (B6)	Nurodo aplinkosaugos novatoriškumo lygį industrijoje ir kitų įmonių technologijų ir aplinkosaugos pažangą		✓	✓
Reguliacija ir mokesčiai (C)	Esama aplinkosaugos reguliacija ir įstatymai (C1)	Nurodo esamus teisės aktus, susijusius su aplinkos apsauga, taršos mažinimu, atliekų tvarkymu ir kt.	✓	✓	✓
	Esami aplinkosaugos mokesčiai ir rinkliavos (C2)	Nurodo esamus mokesčius, rinkliavas ar baudas, susijusias su neigiamu įmonės poveikiu aplinkai	✓	✓	✓
	Ateityje numatoma reguliacija, įstatymai ir mokesčiai (C3)	Nurodo aplinkosaugos reguliaciją ir mokesčius, kurių tikimasi, kad bus taikoma ateityje	✓	✓	✓
Finansinė parama (D)	Finansinė parama iš vietos valdžios institucijų (D1)	Nurodo finansinę vietos ar regionų valdžios institucijų paramą inovacinei veiklai, kuri padeda sumažinti neigiamą poveikį aplinkai	✓	✓	✓
	Finansinė parama iš vyriausybės (D2)	Nurodo finansinę nacionalinės vyriausybės paramą inovacinei veiklai, kuri padeda sumažinti neigiamą poveikį aplinkai	✓	✓	✓
	Finansinė parama iš programos „Europos horizontas“ (D3)	Nurodo finansinę paramą iš programos „Europos horizontas“ inovacijų veiklai, kuri padeda sumažinti neigiamą poveikį aplinkai			✓
	Finansinė parama iš Europos Sąjungos institucijų (D4)	Nurodo Europos Sąjungos institucijų finansinę paramą inovacinei veiklai, kuri padeda sumažinti neigiamą poveikį aplinkai	✓	✓	✓

S3.1 lentelėje pateikiami *Delphi* technikos rezultatai – galutinis kriterijų ir subkriterijų rinkinys, kuris buvo naudotas A, B ir C atvejo tyrimuose parenkant geriausią ekoinovacijų strategiją pasiruošimo internacionalizacijai etape. Geriausios ekoinovacijų strategijos parinkimo procese buvo sistemiškai vertinami ir analizuojami mikro-, mezo- ir makrolygių veiksniai. S3.1 paveiksle parodyti BWM metodo rezultatai – svarbiausių A, B ir C atvejų priskirti subkriterijų svoriai.



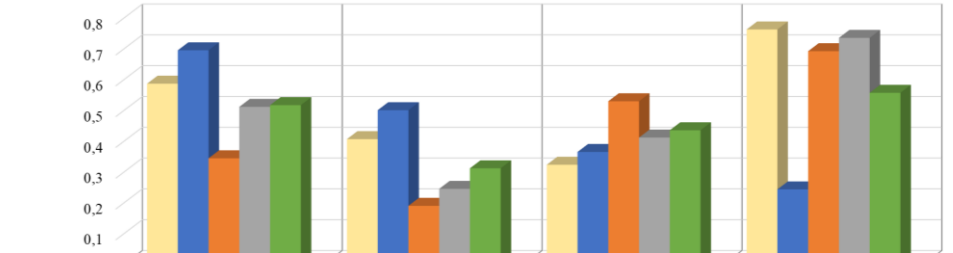
S3.1 pav. Ekoinovacijų strategijos pasirinkimo svarbiausių subkriterijų svorių radarinis grafikas (šaltinis: sudaryta autoriaus)



S3.2 pav. Apibendrinti subkriterijų svoriai ir grafinis Pareto analizės atvaizdavimas (šaltinis: sudaryta autoriaus)

Nors ekoinovacijų strategija parenkama individualios įmonės lygmeniu, kiekvienam subkriterijui atskirų įmonių priskirtų svorių skirtumai yra santykinai nedideli. S3.2 paveiksle pateikti visų įmonių apibendrinti subkriterijų svoriai, reitinguoti mažėjančia tvarka, ir grafinis Pareto analizės atvaizdavimas (pažymėta oranžine linija). Iš rezultatų matoma, kad parenkant geriausią ekoinovacijų strategiją pasiruošimo internacionalizacijai etape, beveik pusė sprendimo svorio (47,90 %) sudaro mezolygmens subkriterijai. Mezolygmens pagrindiniai subkriterijai yra: žaliasis konkurencinis intensyvumas (B3) (13,68 %), klientų paklausa ekologiškiems produktams (B1) (13,38 %) ir klientų paklausa ekologiškiems gamybos procesams (B2) (10,76 %).

Svarbu paminėti, kad daugiau nei trečdalį sprendimo (35,85 %) sudaro mikrolygmens subkriterijai: vadovų susirūpinimas aplinkosauga (A2) sudaro 10,25 %, organizacijos infrastruktūra (A9) – 5,95 %, žaliosios kompetencijos (A4) – 5,62 % ir kt. Galiausiai, tik 16,24 % ekoinovacijos strategijos pasirinkimą lemia makrolygmens aplinka.



	Ekoinovacijų proceso sąnaudų lyderystės strategija	Ekoinovacijų produkto sąnaudų lyderystės strategija	Ekoinovacijų proceso diferenciacijos strategija	Ekoinovacijų produkto diferenciacijos strategija
Bandomasis	0,5868	0,4068	0,3237	0,7629
Atvejis A	0,6952	0,5007	0,3652	0,2437
Atvejis B	0,3446	0,1903	0,5298	0,6923
Atvejis C	0,5115	0,2454	0,4119	0,7355
A, B, C	0,5171	0,3121	0,4356	0,5572

S3.3 pav. Galutiniai ekoinovacijų strategijų suskirstymo pagal svarbą rezultatai (šaltinis: sudaryta autoriaus)

S3.3 paveiksle pateikti galutiniai ekoinovacijų strategijos pasiruošimo internacionalizacijai etape parinkimo rezultatai. Geriausia parinkta ekoinovacijų strategija A įmonės atveju yra ekoinovacijų procesų sąnaudų lyderystės strategija (0,6952); B atveju – ekoinovacijų produkto diferenciacijos strategija (0,6923); C atveju – taip pat ekoinovacijų produkto diferenciacijos strategija (0,73355). Atliktos trijų scenarijų jautrumo analizės patvirtino priimtų sprendimų patikimumą. Svarbu paminėti, kad apibendrintos A, B, C reikšmės (žalia) yra ne tiek svarbis, tačiau svarbi yra išdėstymo pagal svarbą tvarka. Kaip ir Lietuvos baldų pramonės srityje atliktas bandomasis tyrimas, ekoinovacijų strategijos alternatyvų vertinimas apibendrintų trijų įmonių atveju yra labai panašus: ekoinovacijų produktų diferenciacijos strategija yra pirmoji reitinge, o antroji – ekoinovacijų proceso sąnaudų lyderystės strategija.

Bendrosios išvados

1. Mokslinės literatūros analizė parodė, kad stokojama bendro sutarimo, susijusio su ekoinovacijų strategijos koncepcija, o ekoinovacijų strategija, kaip reiškinys, yra mažai tyrinėtas. Atskleista, kad ekoinovacijos daugiausia nagrinėjamos ne iš strateginės įmonės perspektyvos, o kaip atskiros verslo praktikos, ekoinovacijų strategijos samprata tapatinama su organizacijos aplinkosaugos strategija ir neatsižvelgiama į ekoinovacijų, kaip reiškinio, įvairiapusiškumą. Siekiant užpildyti šią mokslinių tyrimų spragą, disertacijoje pasiūlyta nauja ekoinovacijų strategijos koncepcija, pabrėžiant, kad ekoinovacijų strategija integruoja strateginius organizacijos sprendimus, grindžiamus nuolatiniu tobulėjimu ir strategine žaliąja transformacija, diegiant ekoinovacijų rinkinį ir taip siekiant pagerinti įmonės rezultatus išorinėje aplinkoje.
2. Disertacijoje siūloma keturių skirtingų ir tarpusavyje nesąveikaujančių ekoinovacijų strategijos tipų klasifikacija, pagrįsta klasikinėmis konkuravimo strategijomis (išlaidų lyderystė ir diferencijacija) ir nauda, gaunama iš skirtingų ekoinovacijų. Siūloma strategijos tipų klasifikacija ne tik padeda spręsti verslo įmonei kylantį kompromisą, atsirandantį dėl pasirinkimo tarp ekonominių ir aplinkosaugos sprendimų, bet ir pabrėžia konkurencinį pranašumą, įgyjamą tarptautinėse rinkose dėl ekoinovacijų rinkinio.
3. Nustačius, kad mokslinėje literatūroje ekoinovacijų strategijų įmonės internacionalizacijos kontekste tyrimai yra santykinai naujas ir mažai tirtas reiškinys, pagrįstas poreikis tirti ekoinovacijų ir internacionalizacijos sąsają. Argumentuotai pagrįsta, kad ekoinovacijas skatinantys veiksniai skiriasi nuo veiksnių, kuriuos reikia vertinti priimant strateginius sprendimus, todėl siūloma trijų lygmenų (mikro-, mezo- ir makro-) veiksnių, turinčių įtakos ekoinovacijų strategijos parinkimui pasiruošimo internacionalizacijai etape, sistema.
4. Mokslinės literatūros analizė atskleidė, kad gana plačiai tiriamas internacionalizacijos procesas ir įmonės elgsena bei sprendimų priėmimas internacionalizacijos procese, bet pasiruošimo internacionalizacijai etapas sulaukė mažiau dėmesio. Pažymėtina, kad strateginiai sprendimai, priimti pasiruošimo internacionalizacijai etape formuoja tolesnę įmonės augimo tarptautinėse rinkose perspektyvą, todėl pasiūlyta teorinė ekoinovacijų strategijos parinkimo pasiruošimo internacionalizacijai etape sistema, integruojanti siūlomas ekoinovacijų strategijų alternatyvas ir veiksnius, turinčius įtaką ekoinovacijų strategijos parinkimui.
5. Siekiant ištirti strategijos parinkimą pasiruošimo internacionalizacijai etape, pritaikyta mišrių metodų tyrimo strategija, integruojanti kokybinius ir kiekybinius metodus. Integruojamų metodų derinys įgalina sistemiškai vertinti trijų lygmenų veiksnius, veikiančius ekoinovacijų strategijos parinkimą pasiruošimo internacionalizacijai etape. Pasirinktų metodų derinys leidžia lanksčiai įtraukti veiksnių grupes ir veiksnius, atsižvelgiant į kiekvienos įmonės specifinę aplinką.
6. Empirinio tyrimo rezultatai pagrindžia sprendimų priėmimo paramos modelio taikymo galimybes baldų pramonės įmonių kontekste. Pasiūlyta sprendimų priėmimo paramos modelio taikymo metodika empiriškai patikrinta trijų vidutinio

dydžio Lietuvos baldų pramonės gamybos įmonių, kurios yra pasiruošimo internacionalizacijai etape, atveju. Galima teigti, kad sprendimų priėmimo paramos modelis gali būti taikomas kaip paramos priemonė, skirtas sprendimus priimantiems asmenims baldų pramonės gamybos įmonėse, siekiant racionaliai parinkti geriausią ekoinovacijų strategiją pasiruošimo internacionalizacijai etape. Taikant sprendimų priėmimo paramos modelį svarbu įvertinti ir kitus strateginius sprendimus, priimamus pasiruošimo internacionalizacijai etape.

Annexes

Annex A. Previous Studies Related to Eco-innovation and Strategy Selection

Annex B. Delphi Questionnaire

Annex C. Best-Worst Method (BWM) Questionnaire

Annex D. Technique for Order Preference by Similarity to Ideal Solution Method (TOPSIS) Questionnaire

Annex E. Semi-structured Interview Questionnaire

Annex F. Application of Best-Worst Method (BWM) and a Technique for Order Preference by Similarity to Ideal Solution Method (TOPSIS)

Annex A. Previous Studies Related to Eco-Innovation and Strategy Selection

Table A.1. Previous studies related to eco-innovation and strategy selection that applied AHP, BWM and TOPSIS MCDM methods (source: created by the author)

Application goal	**Applied method**	**Author(s), Year**
For analysis of eco-innovation practices based on sustainability performance indicators	Fuzzy AHP, Fuzzy TOPSIS	(Ying Wang & Yang, 2021)
For evaluation of critical factors in the implementation of the eco-innovation	AHP	(Khurana et al., 2021)
For evaluation of eco-innovation abilities	AHP and OVP	(Pan et al., 2020)
For manufacturing strategy selection	AHP	(Chiarini, 2019)
For driver's evaluation for implementation of eco-innovation	Fuzzy AHP, fuzzy TOPSIS	(Guan & Zhao, 2022)
For supplier selection for the adoption of eco-innovation	Fuzzy AHP, fuzzy TOPSIS	(Y. Yang & Wang, 2020)
For evaluation of innovation capabilities of real estate firms	Fuzzy Delphi and DEMATEL	(A. Kumar et al., 2017)
For international market selection	AHP and TOPSIS	(Vanegas-López et al., 2021)
For maintenance strategy selection	BWM and TOPSIS	(Avakh Darestani et al., 2022)
For green supplier selection (automotive manufacturing industry)	BWM and TOPSIS	(Asadabadi et al., 2023)
To overcome barriers to green innovation in SMEs	BWM and fuzzy TOPSIS	(Gupta & Barua, 2018)
For supplier selection on the basis of their green innovation ability	BWM and fuzzy TOPSIS	(Gupta & Barua, 2017)
For prioritization of management scenarios	BWM and TOPSIS	(Alvandi et al., 2021)
For assessment of organizations performance on the basis of green human resource management	BWM and fuzzy TOPSIS	(Gupta, 2018)

Annex B. Delphi Questionnaire

Dear Expert,
Thank you for agreeing to participate in this study and to complete this questionnaire. First, the goal of this questionnaire is to evaluate the relevance of each sub-criterion, which will be further used in the process of selecting the best eco-innovation strategy in the pre-internationalization phase to gain competitive advantage in new international markets.

Please evaluate the relevance of each sub-criterion based on a scale of 1 to 9, when "1" refers to "completely irrelevant" and "9" is "extremely relevant". Also, please submit any missing sub-criteria that you think should be added to the pool.

Table B.1. List of sub-criteria with their explanations (source: created by the author)

Item	Description / Definition	Evaluation
Employees' environmental concern	Refers to the attitudes and pressure of employees towards environmental issues and eco-innovation implementation	
Managerial environmental concern	Refers to the attitudes of top management toward environmental issues and eco-innovation implementation	
Financial resources	Refers to the financial resources of the company and overall financial health	
Green competencies	Refers to the environmental competencies of employees and managers related to the ability to understand, integrate, manage, and exploit environmental knowledge	
Knowledge acquisition capabilities	Refers to the company's ability to identify, obtain, and acquire external environmental knowledge and the number of external partners	
Organizational structure	Refers to intangible elements (hierarchy, structure, internal communication, and administrative apparatus (policies, and procedures, number of environmental departments)) focused on environmental protection	
Organizational infrastructure	Refers to tangible elements, such as facilities, equipment, software, transport, and communication systems that focus on environmental protection	
Customers' demand for green products	Refers to customers' demand for eco-friendly products and when customers pay great attention to the green concept contained in products	
Customers' demand for green production processes	Refers to customers' demand for the overall company's environmental responsibility and eco-friendly production processes	
Green competitive intensity	Refers to the level of competitive intensity and competitive pressure for environmental products and processes, as well as the "how green are the competitors"	
Greenness of the suppliers	Refers to the greenness of current suppliers, the number of green suppliers and the concentration of suppliers in the market, as well as supplier switching costs	
Social pressure	Refers to other stakeholders, non-governmental organizations, environmentalists, and social demands for environmental protection responsibilities	
Environmental innovativeness within the industry	Refers to the level of environmental innovativeness within the industry and how other companies within the industry are technologically and environmentally advanced	

Item	Description / Definition	Evaluation
Existing environmental regulations	Refers to existing environmental regulations for environmental protection, pollution, waste management, etc.	
Existing environmental taxes, charges or fees	Refers to existing environmental taxes, charges, or fees for the company's negative environmental impact	
Environmental regulations or taxes expected in the future	Refers to environmental regulations or taxes that are expected to occur in the future	
Financial support from local or regional authorities	Refers to financial support from local or regional authorities for innovation activities that help reduce the negative environmental impact	
Financial support from the national government	Refers to financial support from the national government for innovation activities that help reduce the negative environmental impact	
Financial support from Horizon Europe Programme	Refers to financial support from Horizon Europe Programme for Research and Innovation for innovation activities that help to reduce negative environmental impact	
Other financial support from a European Union institution	Refers to other financial support from a European Union institution for innovation activities that help to reduce the negative environmental impact	
Any additional sub-criteria that derived from previous steps	Description of the sub-criterion.	
…	Please submit additional sub-criteria if needed. You can add as many rows as you need.	

Annex C. Best-Worst Method (BWM) Questionnaire

Dear Expert,
Thank you for agreeing to participate in this study and to complete this questionnaire. First, the goal of this questionnaire is to determine the relative importance of each criterion (or sub-criterion) in the context of strategic green transformation and implementation of the eco-innovation strategy for competitive advantage in new international markets.

The eco-innovation strategy is a type of strategy integrating strategic decisions of an organization, which are based on continuous improvement and strategic green transformation through the implementation of a set of eco-innovations to enhance the performance of the firm in its external environments.

Please complete the questionnaire and, first, select the most important and least important criteria (or sub-criteria) from each category. Second, compare the importance of the "most important criteria" with others; and other criteria with the "least important criteria".

Questionnaire filling example:

Table C.1. Which of the following criteria is the "most important" and which is the "least important" with respect to the strategic green transformation and the implementation of the eco-innovation strategy to achieve competitive advantage?

Criteria	**Description**	**Importance**
Resources and capabilities	Refers to the micro-level (internal) environment of the firm and a group of existing resources and capabilities that the firm possesses.	**Most important**
Market dynamics	Refers to the meso-level environment of the firm and a group of market forces that is in the external environment of the firm.	
Environmental regulation and taxes	Refers to the macro-level environment of the firm and the government regulation and taxes that are targeting the negative environmental impact.	**Least important**
Public financial support	Refers to the macro-level environment of the firm and the government financial support for mitigating the negative environmental impact.	

Table C.2. How much more important is the "most important criteria" compared to others on a scale of 1 to 9, when "1" refers to "equally important" and "9" is "extremely more important"?

Criteria	**Importance**								
Resources and capabilities	**1**	2	3	4	5	6	7	8	9
Market dynamics	1	**2**	3	4	5	6	7	8	9
Environmental regulation and taxes	1	2	3	4	**5**	6	7	8	9
Public financial support	1	2	**3**	4	5	6	7	8	9

Table C.3. How much more important are other criteria compared to the "least important criteria" on a scale of 1 to 9, when "1" refers to "equally important" and "9" is "extremely more important"?

Criteria	Importance								
Resources and capabilities	1	2	3	4	**5**	6	7	8	9
Market dynamics	1	2	**3**	4	5	6	7	8	9
Environmental regulation and taxes	**1**	2	3	4	5	6	7	8	9
Public financial support	1	**2**	3	4	5	6	7	8	9

Please read the questions carefully before responding:

Table C.4. Which of the following criteria is the "most important" and which is the "least important" with respect to the strategic green transformation and the implementation of the eco-innovation strategy to achieve competitive advantage?

Criteria	Description	Importance
Resources and capabilities	Refers to the micro-level (internal) environment of the firm and a group of existing resources and capabilities that firm possesses.	
Market dynamics	Refers to the meso-level environment of the firm and a group of market forces that is in the external environment of the firm.	
Environmental regulation and taxes	Refers to the macro-level environment of the firm and the government regulation and taxes that are targeting the negative environmental impact.	
Public financial support	Refers to the macro-level environment of the firm and the government financial support for mitigating the negative environmental impact.	

Table C.5. How much more important is the "most important criteria" compared to others on a scale of 1 to 9, when "1" refers to "equally important" and "9" is "extremely more important"?

Criteria	Importance								
Resources and capabilities	1	2	3	4	5	6	7	8	9
Market dynamics	1	2	3	4	5	6	7	8	9
Environmental regulation and taxes	1	2	3	4	5	6	7	8	9
Public financial support	1	2	3	4	5	6	7	8	9

Table C.6. How much more important are other criteria compared to the "least important criteria" on a scale of 1 to 9, when "1" refers to "equally important" and "9" is "extremely more important"?

Criteria	Importance								
Resources and capabilities	1	2	3	4	5	6	7	8	9
Market dynamics	1	2	3	4	5	6	7	8	9
Environmental regulation and taxes	1	2	3	4	5	6	7	8	9
Public financial support	1	2	3	4	5	6	7	8	9

Table C.7. Which of the following sub-criteria is the "most important" and which is the "least important" with respect to the strategic green transformation and the implementation of the eco-innovation strategy to achieve competitive advantage?

Sub-criteria	Description	Importance
Employees' environmental concern	Refers to the attitudes and pressure of employees towards environmental issues and eco-innovation implementation	
Managerial environmental concern	Refers to the attitudes of top management toward environmental issues and eco-innovation implementation	
Financial resources	Refers to the financial resources of the company and overall financial health	
Green competencies	Refers to the environmental competencies of employees and managers related to the ability to understand, integrate, manage, and exploit environmental knowledge	
Knowledge acquisition capabilities	Refers to the company's ability to identify, obtain, and acquire external environmental knowledge and the number of external partners	
Organizational structure	Refers to intangible elements (hierarchy, structure, internal communication, and administrative apparatus (policies, and procedures, number of environmental departments)) focused on environmental protection	
Organizational infrastructure	Refers to intangible elements, such as hierarchy, structure, internal communication, and administrative apparatus (policies, and procedures) focus on environmental protection	
Additional sub-criteria from SWOT analysis	*Description*	

Table C.8. How much more important is the "most important sub-criteria" compared to others on a scale of 1 to 9, when "1" refers to "equally important" and "9" is "extremely more important"?

Sub-criteria	Importance								
Employees' environmental concern	1	2	3	4	5	6	7	8	9
Managerial environmental concern	1	2	3	4	5	6	7	8	9
Financial resources	1	2	3	4	5	6	7	8	9
Green competencies	1	2	3	4	5	6	7	8	9
Knowledge acquisition capabilities	1	2	3	4	5	6	7	8	9
Organizational structure	1	2	3	4	5	6	7	8	9
Organizational infrastructure	1	2	3	4	5	6	7	8	9
Additional sub-criteria from SWOT analysis	1	2	3	4	5	6	7	8	9

Table C.9. How much more important are other sub-criteria compared to the "least important sub-criteria" on a scale of 1 to 9, when "1" refers to "equally important" and "9" is "extremely more important"?

Sub-criteria	Importance								
Employees' environmental concern	1	2	3	4	5	6	7	8	9
Managerial environmental concern	1	2	3	4	5	6	7	8	9
Financial resources	1	2	3	4	5	6	7	8	9

Sub-criteria	Importance								
Green competencies	1	2	3	4	5	6	7	8	9
Knowledge acquisition capabilities	1	2	3	4	5	6	7	8	9
Organizational structure	1	2	3	4	5	6	7	8	9
Organizational infrastructure	1	2	3	4	5	6	7	8	9
Additional sub-criteria from SWOT analysis	1	2	3	4	5	6	7	8	9

Table C.10. Which of the following sub-criteria is the "most important" and which is the "least important" with respect to the strategic green transformation and the implementation of the eco-innovation strategy to achieve competitive advantage?

Sub-criteria	Description	Importance
Customers' demand for green products	Refers to customers' demand for eco-friendly products and when customers pay great attention to the green concept contained in products	
Customers' demand for green production processes	Refers to customers' demand for the overall company's environmental responsibility and eco-friendly production processes	
Green competitive intensity	Refers to the level of competitive intensity and competitive pressure for environmental products and processes, as well as the "how green are the competitors"	
Greenness of the suppliers	Refers to the greenness of current suppliers, the number of green suppliers and the concentration of suppliers in the market, as well as supplier switching costs	
Social pressure	Refers to other stakeholders, non-governmental organizations, social demands, environmentalists, and demand for overall company's environmental responsibility	
Environmental innovativeness within the industry	Refers to the level of environmental innovativeness within the industry and how other companies within the industry are technologically and environmentally advanced	
Additional sub-criteria from SWOT analysis	*Description*	

Table C.11. How much more important is the "most important sub-criteria" compared to others on a scale of 1 to 9, when "1" refers to "equally important" and "9" is "extremely more important"?

Sub-criteria	Importance								
Customers' demand for green products	1	2	3	4	5	6	7	8	9
Customers' demand for green production processes	1	2	3	4	5	6	7	8	9
Green competitive intensity	1	2	3	4	5	6	7	8	9
Greenness of the suppliers	1	2	3	4	5	6	7	8	9
Social pressure	1	2	3	4	5	6	7	8	9
Environmental innovativeness within the industry	1	2	3	4	5	6	7	8	9
Additional sub-criteria from SWOT analysis	1	2	3	4	5	6	7	8	9

Table C.12. How much more important are other sub-criteria compared to the "least important sub-criteria" on a scale of 1 to 9, when "1" refers to "equally important" and "9" is "extremely more important"?

Sub-criteria	**Importance**								
Customers' demand for green products	1	2	3	4	5	6	7	8	9
Customers' demand for green production processes	1	2	3	4	5	6	7	8	9
Green competitive intensity	1	2	3	4	5	6	7	8	9
Greenness of the suppliers	1	2	3	4	5	6	7	8	9
Social pressure	1	2	3	4	5	6	7	8	9
Environmental innovativeness within the industry	1	2	3	4	5	6	7	8	9
Additional sub-criteria from SWOT analysis	1	2	3	4	5	6	7	8	9

Table C.13. Which of the following sub-criteria is the "most important" and which is the "least important" with respect to the strategic green transformation and the implementation of the eco-innovation strategy to achieve competitive advantage?

Sub-criteria	**Description**	**Importance**
Existing environmental regulations	Refers to existing environmental regulations for environmental protection, pollution, waste management, etc.	
Existing environmental taxes, charges or fees	Refers to existing environmental taxes, charges, or fees for the company's negative environmental impact	
Environmental regulations or taxes expected in the future	Refers to environmental regulations or taxes that are expected to occur in the future	

Table C.14. How much more important is the "most important sub-criteria" compared to others on a scale of 1 to 9, when "1" refers to "equally important" and "9" is "extremely more important"?

Sub-criteria	**Importance**								
Existing environmental regulations	1	2	3	4	5	6	7	8	9
Existing environmental taxes, charges or fees	1	2	3	4	5	6	7	8	9
Environmental regulations or taxes expected in the future	1	2	3	4	5	6	7	8	9

Table C.15. How much more important are other sub-criteria compared to the "least important sub-criteria" on a scale of 1 to 9, when "1" refers to "equally important" and "9" is "extremely more important"?

Sub-criteria	**Importance**								
Existing environmental regulations	1	2	3	4	5	6	7	8	9
Existing environmental taxes, charges or fees	1	2	3	4	5	6	7	8	9
Environmental regulations or taxes expected in the future	1	2	3	4	5	6	7	8	9

Table C.16. Which of the following sub-criteria is the "most important" and which is the "least important" with respect to the strategic green transformation and the implementation of the eco-innovation strategy to achieve competitive advantage?

Sub-criteria	Description	Importance
Financial support from local or regional authorities	Refers to financial support for innovation activities that help reduce the negative environmental impact of local or regional authorities	
Financial support from the national government	Refers to financial support for innovation activities that help reduce the negative environmental impact of the national government	
Financial support from Horizon Europe Programme for Research and Innovation	Refers to financial support for innovation activities that help to reduce negative environmental impact from Horizon Europe Programme for Research and Innovation	
Other financial support from a European Union institution	Refers to other financial support from a European Union institution for innovation activities that help to reduce the negative environmental impact	

Table C.17. How much more important is the "most important sub-criteria" compared to others on a scale of 1 to 9, when "1" refers to "equally important" and "9" is "extremely more important"?

Sub-criteria	Importance								
Financial support from local or regional authorities	1	2	3	4	5	6	7	8	9
Financial support from the national government	1	2	3	4	5	6	7	8	9
Financial support from Horizon Europe Programme for Research and Innovation	1	2	3	4	5	6	7	8	9
Other financial support from a European Union institution	1	2	3	4	5	6	7	8	9

Table C.18. How much more important are other sub-criteria compared to the "least important sub-criteria" on a scale of 1 to 9, when "1" refers to "equally important" and "9" is "extremely more important"?

Sub-criteria	Importance								
Financial support from local or regional authorities	1	2	3	4	5	6	7	8	9
Financial support from the national government	1	2	3	4	5	6	7	8	9
Financial support from Horizon Europe Programme for Research and Innovation	1	2	3	4	5	6	7	8	9
Other financial support from a European Union institution	1	2	3	4	5	6	7	8	9

Annex D. A Technique for Order Preference by Similarity to Ideal Solution Method (TOPSIS) Questionnaire

Dear Expert,
Thank you for agreeing to participate in this study and complete this questionnaire. This is the last part of the questionnaire and the goal of this step is to rate the performance of each strategic alternative with respect to each sub-criterion.

Table D.1. Questionnaire filling example.

Strategic alternatives / **Sub-criteria**	Eco-innovation process cost leadership strategy	Eco-innovation product cost leadership strategy	Eco-innovation process differentiation strategy	Eco-innovation product differentiation strategy
Employees' environmental concern *How likely would the employees support each strategy? (when 1 – very unlikely and 10 – very likely)*	5	1	10	8

Please rate the performance of each strategic alternative giving a value from 1 to 10 with respect to each of the sub-criterion. See the auxiliary questions next to each sub-criterion for value (1-10) meanings.

Table D.2. Table to assess the performance of each strategic alternative with respect to each sub-criterion.

Strategic alternatives / **Sub-criteria**	Eco-innovation process cost leadership strategy	Eco-innovation product cost leadership strategy	Eco-innovation process differentiation strategy	Eco-innovation product differentiation strategy
Employees' environmental concern *How likely would the employees support each strategy? (when 1 – very unlikely and 10 – very likely)*				
Managerial environmental concern *How likely would the top management support each strategy? (when 1 – very unlikely and 10 – very likely)*				
Financial resources *How effectively can our financial resources be used for each strategy? (when 1 – ineffectively and 10 – highly effectively)*				
Green competencies				

Strategic alternatives / **Sub-criteria**	Eco-innovation process cost leadership strategy	Eco-innovation product cost leadership strategy	Eco-innovation process differentiation strategy	Eco-innovation product differentiation strategy
How effectively can our green competencies be used for each strategy? (when 1 – ineffectively and 10 – highly effectively)				
Knowledge acquisition capabilities *How effectively can our knowledge acquisition capabilities be used for each strategy? (when 1 – ineffectively and 10 – highly effectively)*				
Organizational structure *How suitable is our organization structure for each strategy? (when 1 – very unsuitable and 10 – very suitable)*				
Organizational infrastructure *How suitable is our organization infrastructure for each strategy? (when 1 – very unsuitable and 10 – very suitable)*				
Customers' demand for green products *How likely would each strategy satisfy the customers' demand for green products? (when 1 – very unlikely and 10 – very likely)*				
Customers' demand for green production processes *How likely would each strategy satisfy the customers' demand for green production processes? (when 1 – very unlikely and 10 – very likely)*				
Green competitive intensity *How likely would each strategy let us gain an upper hand against competitors? (when 1 – very unlikely and 10 – very likely)*				
Greenness of the suppliers *How likely would the greenness of the suppliers benefit each strategy? (when 1 – very unlikely and 10 – very likely)*				
Social pressure *How likely would each strategy let us deal with social pressure? (when 1 – very unlikely and 10 – very likely)*				
Environmental innovativeness within the industry *How likely would each strategy benefit our activities within the scope of the industry? (when 1 – very unlikely and 10 – very likely)*				
Existing environmental regulations				

Strategic alternatives / **Sub-criteria**	Eco-innovation process cost leadership strategy	Eco-innovation product cost leadership strategy	Eco-innovation process differentiation strategy	Eco-innovation product differentiation strategy
How likely would each strategy let us cope with existing environmental regulations? (when 1 – very unlikely and 10 – very likely)				
Existing environmental taxes, charges or fees *How likely would each strategy let us cope with existing environmental taxes, charges or fees? (when 1 – very unlikely and 10 – very likely)*				
Environmental regulations or taxes expected in the future *How likely would each strategy let us cope with environmental regulations or taxes that will occur in the future? (when 1 – very unlikely and 10 – very likely)*				
Financial support from local or regional authorities *How accessible is the financial support from the local or regional authorities with respect to each strategy? (when 1 – not accessible and 10 – highly accessible)*				
Financial support from the national government *How accessible is the financial support from the national government with respect to each strategy? (when 1 – not accessible and 10 – highly accessible)*				
Financial support from Horizon Europe Programme for Research and Innovation *How accessible is the financial support from the Horizon Europe Programme for Research and Innovation with respect to each strategy? (when 1 – not accessible and 10 – highly accessible)*				
Other financial support from a European Union institution *How accessible is the financial support from a European Union institution with respect to each strategy? (when 1 – not accessible and 10 – highly accessible)*				
Any additional sub-criteria that derived from previous steps. *Auxiliary question for experts for values (1-10) meanings.*				

Annex E. Semi-structured Interview Questionnaire

00. Introduction
Q0.0. Dear …,
Thank you for agreeing to participate in this research.
I am Paulius Šūmakaris, PhD student from Vilnius Gediminas Technical University. My research focuses on eco-innovation strategies in the development of internationalization.
The main goal of this research is to explore how decisions regarding eco-innovation practices are made in the context of internationalization.
This interview will take about one hour.
I would like to ask you if you agree for this interview to be sound-recorded? The recording will be used only for analysis purposes and will be kept confidential and will not be shared with any third party. All the data collected during this interview will not be disclosed and reported anonymously.
Thank you very much. We will proceed to the interview questions then, but first, for clarity of the interview process, I will briefly introduce the most commonly used terms in this interview and provide examples to avoid different interpretations of the terms.

Q0.1. Throughout the interview, I will be referring to such terms:

- Internationalization or international development is a process of increasing commitments to foreign markets, such as: export, trade, collaboration, branches, and joint ventures, etc., that extend beyond the home country.
- Innovation – a new or improved product or business process (or combination thereof) that differs significantly from the firm's previous products or business processes and that has been introduced on the market or brought into use by the firm.
- Eco-innovation – is based on the "traditional innovation with a reduction in a negative environmental impact" and any innovation could be an eco-innovation as long as it is more environmentally friendly than the relevant alternative. Examples such as environmental certificates, eco-labels, introduced recyclable packaging, toxic-free materials, etc.

Throughout the interview, I will introduce other specific terms at the time of asking the question, and please feel free to ask for a clarification during this whole interview process if needed to avoid misunderstandings.

Q1. Eligibility criteria and generic information
Q1.00. First, I would like to know more about yourself and the (*company name*) as well as your personal and company experience.

Q1a.00. *Questions related to CEO's demographic information and professional experience:*
Q1a.01. What is your formal education?
Q1a.02. Your age?
Q1a.03. Your tenure at the current company as CEO in years?
Q1a.04. Your total number of years working in a top-level management position?

Q1a.05. Your total number of completed or ongoing projects related to internationalization?
Q1a.06. Your total number of completed or ongoing projects related to eco-innovation?

Q1b.00. *Questions related to company:*
Q1b.01. What are the main economic activities of the company?
Q1b.02. Does the company currently have its parent company, is it part of a holding, or something similar?
Q1b.03. Is the company currently exporting to any foreign markets or is it involved or committed in some way to international markets?
Q1b.04. What is the company's internationalization experience in years? When was the first time the company exported to foreign market(s) and continues to do so? If you had, please exclude one-time export activities.
Q1b.05. Without providing any specific numbers on actual sales, lets talk about share of sales: - What is the current share of sales abroad? - What is the current share of sales of green vs non-green products? - What is the current number of foreign markets to which your company sells products? – What is the current share of sales of products sold to B2B vs B2C (total and abroad) (business-to-business/ consumer)?
Q1b.06. Is your company currently or in the near future considering entering a new foreign market?
Q1b.07. Have you selected the new foreign market? *IF YES* – mind, if I ask – which?
Q1b.08. Has the company implemented eco-innovations in the last 5 years? (product and/ or process eco-innovations such as environmental certificates, eco-labels, introduced recyclable packaging, toxic-free materials, etc.).

Q2. Internationalization
Q2.00. Now I would like to speak with you about the internationalization and international development (*remind the definition of internationalization if needed*).

Q2.01. How important is internationalization for the (*company name*) and the overall long-term strategy and why?

Q2.02. How important is the green aspect i.e., "being green" in the international development of the (*company name*) and why?

Q2.03. Would you say that the current competitive strategy in international markets of (*company name*) is cost leadership or differentiation? (*explain the terms if necessary*). How does it differ depending on the foreign market or home country?

Q2.04. Would you say that mainly, your competitive advantage in international markets comes from products or processes? To put it simply – does the competitive advantage come from "what" you produce or "how" you produce? How does it differ depending on the foreign markets or home country?

Q2.05. Does your company have strategic partners/ alliances that are formed specifically for internationalization? *IF YES* - what benefits are you getting from the partnerships?

Q3. Pre-internationalization phase
Q3.00. Now I would like to speak with you about your experience with respect to the "before internationalization" time period, i.e., the initial decision to internationalize and to enter a new foreign market.

Q3.01. Were you, as a CEO, involved in the (*company name*) new foreign market entry processes? *IF YES* – when that was that and what were the markets?

Q3a.00. *Ask only if the CEO was involved in previous internationalization cases:*
Q3a.01. How did you prepare for foreign market entry? What strategic activities or decisions were made with respect to preparatory work in previous internationalization cases and why? Please provide examples.

Q3a.02. Have you considered and how important was the green aspect in this "before internationalization" stage for the (*company name*) and why? What is the reasoning behind it? Was there any specific green preparatory work done and why?

Q3b.00. *Ask all:*
Q3b.01. How are you currently preparing for the entrance of the new selected foreign market? What strategic activities or decisions are currently being implemented? Why these strategic activities? Please provide examples.

Q3b.02. How many people or departments are involved in the (*company name*) when considering entering a new foreign market?

Q3b.03. Question related to the level of commitment. For example, if the maximum level of commitment is considered as opening a branch or manufacturing or sales department, and the lowest level of commitment is considered as export of the products, and with contracted production and licensing falling in between. How do you decide how much to commit to currently selected new foreign market and why? Please provide reasoning examples.

Q3b.04. What is the level of commitment to current international markets? Please provide examples. *IF EXPORT* – what are the sales channels?

Q3c.00. *Ask only if the CEO was involved in previous internationalization cases:*
Q3c.01. How does this preparation for entrance of the new selected foreign market differ from previous ones? Please provide examples.

Q4. Eco-innovation
Q4.00. Now I would like to speak with you about the eco-innovation (*remind the definition of eco-innovation if needed*).

Q4.01. Were you, as CEO, involved in the previous (*company name*) eco-innovation implementation processes? *IF YES* – what type of eco-innovations have been implemented in the last 5 years? As a reference point, lets talk about eco-innovations in all green business value chain areas (*green business value chain: green management; green information systems; green technology; green supply chain management (green design, green purchasing, green production, green logistics); green accounting and finance; 3R practice; green marketing*)? Please provide examples.

Q4a.00. *Ask only if the CEO was involved in previous eco-innovation implementation processes:*
Q4a.01. Were there eco-innovations that specifically were implemented because of international development? *IF YES* - Please provide examples.

Q4a.02. Which of the implemented eco-innovations were the most important with regard to international development and why? Please provide examples.

Q4b.00. *Ask all:*
Q4b.01. In the context of eco-innovation implementation for international development of the (*company name*), how important are eco-innovations in international development, and why?

Q4b.02. Which of the implemented eco-innovations were the most important with the overall (*company name*) strategy and why? Please provide examples.

Q4b.03. How many people or departments are involved when considering the eco-innovation implementation?

Q4b.04. How do you set strategic priorities for eco-innovation outcomes or expected results and why? For example: A: eco-innovations that save costs or B: differentiate your company from rivalry. Please provide examples.

Q4b.05. How do you set strategic priorities for eco-innovation outcomes or expected results and why? For example: A: eco-innovations that transform products or B: processes of your company. Please provide examples.

Q4b.06. How do you decide which eco-innovation to implement and why? For example, in your company, eco-innovations are implemented based on which of the two approaches: A – there is a specific eco-innovation available to us (i.e., ISO14001), so we should implement it; or B – one of the areas of our company is not environmentally friendly enough (i.e., our logistics), so what are the possible solutions? Please provide examples.

Q4b.07. How do you decide which specific green business value chain area you prefer to introduce eco-innovations and why? (*green business value chain: green management;*

green information systems; green technology; green supply chain management (green design, green purchasing, green production, green logistics); green accounting and finance; 3R practice; green marketing)? Please provide examples.

Q4b.08. Does your company have strategic partners/ alliances that are formed specifically for eco-innovation? *IF YES* - what benefits are you getting from the partnerships?

5. Micro-; meso-; macro-level factors
Q5.00. Now I would like to speak with you about your experiences related to strategic decisions to eco-innovation implementation. For this part we will focus on different levels of the company: 1 level – internal level, meaning only resources and capabilities of the (*company name*), such as financial, managerial, competences and etc.; 2 level – market level, meaning customers, competitors, suppliers, and etc.; 3 level – macro level, meaning government regulation, taxes, subsidies and etc.

Q5a. Micro-level
Q5a.00. Within the boundaries of your company in the context of decisions related to eco-innovation implementation:

Q5a. Micro-level question is structured as follows:
Q5a.0X. How important are the (*sub-criterion description from the list*) in the process of decision-making related to eco-innovation?
Ask additionally if the CEO was previously involved in eco-innovation implementation: For example, how important were (*sub-criterion description from the list*) when implementing (*example of implemented eco-innovation*). How did that reflect in the decision, and why? Provide examples of how that was reflected in the decision.

Example:
Q5a.01. How important are the attitudes and pressure of employees towards environmental issues and the implementation of eco-innovation in the process of decision-making related to eco-innovation?
Ask additionally if the CEO was previously involved in eco-innovation implementation: For example, how important were the attitudes and pressure of employees toward environmental issues and implementation of eco-innovation when implementing (*example of implemented eco-innovation*). How did that reflect in the decision, and why? Provide examples of how that was reflected in the decision.

Table E.1. List of sub-criteria with their explanations (source: created by the author)

Sub-criteria (Micro-level)	**Description**
Employees' environmental concern	Refers to the attitudes and pressure of employees towards environmental issues and eco-innovation implementation
Managerial environmental concern	Refers to the attitudes of top management toward environmental issues and eco-innovation implementation

Sub-criteria (Micro-level)	Description
Financial resources	Refers to the financial resources of the company and overall financial health
Green competencies	Refers to the environmental competencies of employees and managers related to the ability to understand, integrate, manage, and exploit environmental knowledge
Knowledge acquisition capabilities	Refers to the company's ability to identify, obtain, and acquire external environmental knowledge
Organizational structure	Refers to intangible elements (hierarchy, structure, internal communication, and administrative apparatus (policies, and procedures)) focused on environmental protection
Organizational infrastructure	Refers to tangible elements (facilities, equipment, software, transport, and communication systems) that focus on environmental protection

Q5a.07. Are there other specific internal factors that I have not mentioned that are evaluated or reflected in previous eco-innovation implementation decisions? Please provide examples.

Q5a.08. From the internal factors, which do you think are the most important and why?

Q5b. Meso-level:
Q5b.00. Within the market level, in the context of decisions related to eco-innovation implementation:

Q5b. Meso-level question is structured as follows:
Q5b.0X. How important is the (*sub-criterion description from the list*) in the process of decision-making related to eco-innovation?
Ask additionally if the CEO was previously involved in eco-innovation implementation: For example, how important were (*sub-criterion description from the list*) when implementing (*example of implemented eco-innovation*). How did that reflect in the decision, and why? Provide examples of how that was reflected in the decision.

Example:
Q5b.01. How important is the customers' demand for eco-friendly products and when customers pay great attention to the green concept contained in products in the process of decision-making related to eco-innovation?
Ask additionally if the CEO was previously involved in eco-innovation implementation: For example, (*example of implemented eco-innovation*), how important was the customers' demand for green products, how did that reflect in the decision, and why? Provide examples of how that was reflected in the decision.

Table E.2. List of sub-criteria with their explanations (source: created by the author)

Sub-criteria (Meso-level)	**Description**
Customers' demand for green products	Refers to customers' demand for eco-friendly products and when customers pay great attention to the green concept contained in products
Customers' demand for green production processes	Refers to customers' demand for overall company's environmental responsibility and eco-friendly production processes
Green competitive intensity	Refers to the level of competitive intensity and competitive pressure for environmental products and processes, as well as the "how green are the competitors"
Greenness of the suppliers	Refers to the greenness of current suppliers, number of green suppliers, and the concentration of suppliers in the market, as well as supplier switching costs
Social pressure	Refers to other stakeholders, non-governmental organizations, environmentalists, and social demands for environmental responsibilities
Environmental innovativeness within industry	Refers to the level of environmental innovativeness within industry and technological and environmental advancement of other companies

Q5b.07. Are there other specific market factors or stakeholders that I have not mentioned that are evaluated or reflected in previous eco-innovation implementation decisions? Please provide examples.

Q5b.08. From the market level factors, which do you think are the most important and why?

Q5c. Macro-level
Q5c.00. Within the macro level – government subsidies, regulations or taxes, in the context of decisions related to eco-innovation implementation:

Q5c. Macro-level question is structured as follows:
Q5C.0X. How important is the (*sub-criterion description from the list*) in the process of decision-making related to eco-innovation?
Ask additionally if the CEO was previously involved in eco-innovation implementation: For example, how important were (*sub-criterion description from the list*) when implementing (*example of implemented eco-innovation*). How did that reflect in the decision, and why? Provide examples of how that was reflected in the decision.

Example:
Q5c.01. How important is the existing environmental regulations, such as regulation on pollution, waste management, etc. in the process of decision-making related to eco-innovation?

Ask additionally if the CEO was previously involved in eco-innovation implementation: For example, (*example of implemented eco-innovation*), how important was the at the time existing environmental regulations, how did that reflect in the decision, and why? Provide examples of how that was reflected in the decision.

Table E.3. List of sub-criteria with their explanations (source: created by the author)

Sub-criteria (Macro-level)	**Description**
Existing environmental regulations	Refers to existing environmental regulations for environmental protection, pollution, waste management, etc.
Existing environmental taxes, charges or fees	Refers to existing environmental taxes, charges or fees for the company's negative environmental impact
Regulations or taxes expected in the future	Refers to environmental regulations or taxes that are expected to occur in the future
Financial support from local authorities	Refers to financial support from local or regional authorities for innovation activities that help reduce the negative environmental impact
Financial support from national government	Refers to financial support from the national government for innovation activities that help reduce the negative environmental impact
Financial support from Horizon Europe	Refers to financial support from Horizon Europe Programme for innovation activities that help to reduce the negative environmental impact
Financial support from a European Union	Refers to financial support from a European Union institution for innovation activities that help to reduce the negative environmental impact

Q5c.08. Are there other specific macro level factors or stakeholders that I have not mentioned that are evaluated or reflected in previous eco-innovation implementation decisions? Please provide examples.

Q5c.09. From the macro level factors, which do you think are the most important and why?

6. Other

Q6.00. And the last few questions before we complete the interview with respect to eco-innovation in international development:

Q6.01. Is there anything else you think is important that I did not mention that you would like to share or add related to eco-innovation in international development?

Q6.02. Can you think of someone who was involved in the similar eco-innovation and international development processes that we have discussed in this interview? Maybe you can provide references who could also potentially participate in this research and share his/her experience?

I am very grateful for your participation and valuable input.

Annex F. Application of Best-Worst Method (BWM) and a Technique for Order Preference by Similarity to Ideal Solution Method (TOPSIS)

The integration of both MCDM has been accomplished by using criteria and sub-criterion weights obtained from BWM and incorporated into TOPSIS to rank the best eco-innovation strategy alternative. The illustrated schematic diagram of the BWM-TOPSIS application is presented in Figure F.1.

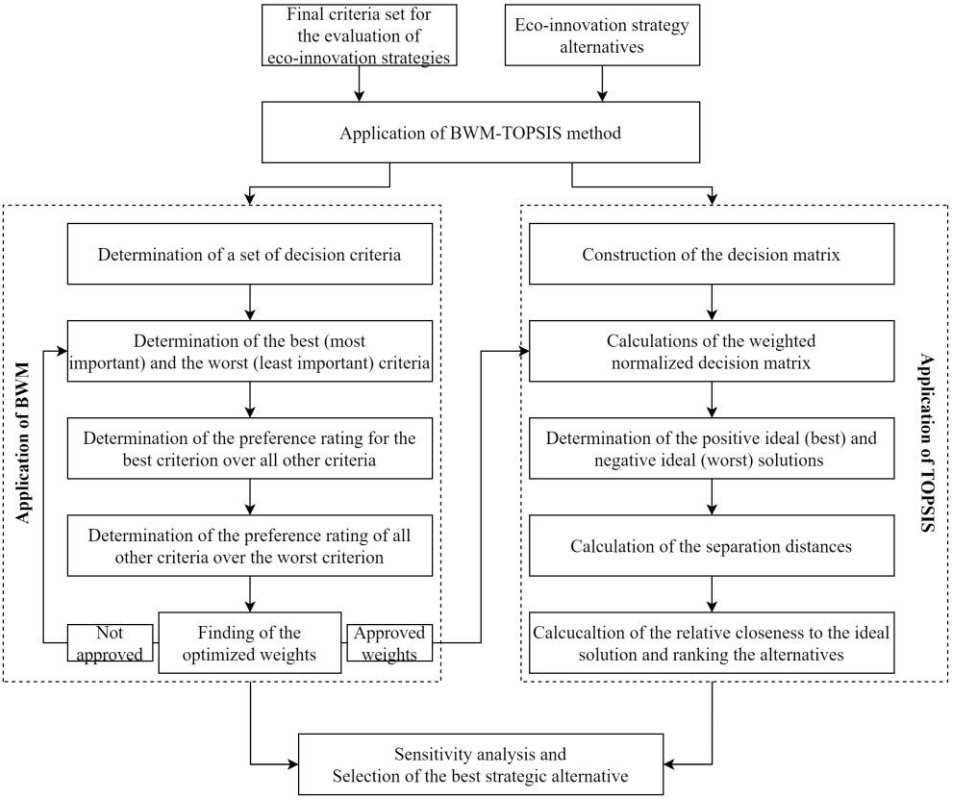


Fig. F.1. The illustrated schematic diagram of the BWM-TOPSIS method (source: created by the author)

Application of BWM.

The application of BWM is mainly based on five steps (Rezaei, 2015):

Step 1. The determination of a set of decision criteria that should be used for decision-making. In this step, the criteria are defined as (C_1, C_2, …, C_n), which is required to make a decision. The set of criteria was determined based on the methodology presented in the

Second Chapter. Four main criteria are identified and a certain number of sub-criteria for each criterion, which are depending on the expert groups previously applied Delphi technique. Weighting of sub-criteria provides local weights, when for obtaining the global weights for each sub-criterion the weights of the corresponding main criterion is multiplied by the local weights of each sub-criterion (Rezaei et al., 2018).

Step 2. The determination of the best (i.e., most important) and the worst (i.e., least important) criteria and sub-criteria for each group of finalized criteria set. In this step, each expert from the decision-making group chooses the best and the worst criteria among the set of criteria from his/her own perspective. In the context of the decision problem, experts were asked to select the best and the worst criterion (or sub-criterion) when the best criterion is defined as the most important in the selection of the eco-innovation strategy, while the worst criterion is the least important.

Step 3. the determination of the preference rating for the best criterion over all other criteria. In this step, each expert from the decision-making group conducts a pairwise comparison between the best criterion and the other criteria. The aim of this step is to determine the importance of the selected best criterion to the all-other criteria, and the comparison is made according to a standard and straightforward 1–9-point scale, when 1 is "equally important", and 9 is "extremely more important". The comparison result is expressed by a "Best-to-Others" vector, where a_{Bj}indicates the preference of the best criterion *B* over criterion *j*, and $a_{BB} = 1$, as follows:

$$A_B = a_{B1}, a_{B2}, \dots, a_{Bn}, \tag{F.1}$$

Step 4. Similarly, the determination of the preference rating of all other criteria over the worst criterion. In this step, each expert from the decision-making group conducts a pairwise comparison between the worst criterion and the other criteria. The aim of this step is to determine the importance all-other criteria compared to selected worst criteria, and the comparison is made according to a standard and straightforward 1–9-point scale, when 1 is "equally important", and 9 is "extremely more important". The comparison result is expressed by a "Others-to-Worst" vector, where the a_{jW}indicates the preference of the criterion *j* over the worst criterion *W*, and the $a_{WW} = 1$, as follows:

$$A_W = (a_{1W}, a_{2W}, \dots, a_{nW})^T, \tag{F.2}$$

Step 5. The calculation of all the criteria and sub-criteria and finding of the optimized weights (w_1^*, w_2^*, w_{n1}^*). For each pair of w_B/w_j and w_j/w_W, the optimal weight should meet the requirement that $w_B/w_j = a_{Bj}$ and $w_j/w_W = a_{jW}$. To satisfy the conditions, the maximum absolute differences $\left|\frac{w_B}{w_j} - a_{Bj}\right|$ and $\left|\frac{w_j}{w_W} - a_{jW}\right|$ for all j is minimized. Also taking into consideration the non-negativity characteristic and sum condition of the weights, the following problem formulated as follows:

$$\min max = \left\{\left|\frac{w_B}{w_j} - a_{Bj}\right|, \left|\frac{w_j}{w_W} - a_{jW}\right|\right\} \tag{F.3}$$

st.

$$\sum_j w_j = 1$$

$$w_j \geq 0, \text{for all } j$$

Moreover, the above model can be converted to the following:

$$\min \xi$$

st.

$$\begin{gathered} \left|\frac{w_B}{w_j} - a_{Bj}\right| \leq \xi, \text{for all } j \\ \left|\frac{w_j}{w_W} - a_{jW}\right| \leq \xi, \text{for all } j \\ \sum_j w_j = 1 \\ w_j \geq 0, \text{for all } j \end{gathered} \tag{F.4}$$

By solving the optimization problem, the optimal weights (w_1^*, w_2^*, w_{n1}^*) and ξ^* can be obtained. For not-fully consistent problems with more than three criteria there might be more than one optimal solution (Rezaei et al., 2015). As such, the following two models are used to calculate the lower and upper bounds of the weight of criterion *j*. These models are solved after solving model (23) and finding ξ^* (Rezaei, 2016).

$$\min w_j$$

st.

$$\begin{gathered} \left|\frac{w_B}{w_j} - a_{Bj}\right| \leq \xi^*, \text{for all } j \\ \left|\frac{w_j}{w_W} - a_{jW}\right| \leq \xi^*, \text{for all } j \\ \sum_j w_j = 1 \\ w_j \geq 0, \text{for all } j \end{gathered} \tag{F.5}$$

$$max\, w_j$$

$$st.$$

$$\left|\frac{w_B}{w_j} - a_{Bj}\right| \leq \xi^*, for\ all\ j \tag{F.6}$$

$$\left|\frac{w_j}{w_W} - a_{jW}\right| \leq \xi^*, for\ all\ j$$

$$\sum_j w_j = 1$$

$$w_j \geq 0, for\ all\ j$$

Solving these two models for all the criteria it is possible to find the upper and lower bounds of the weights of the criteria. So, we have an optimal weight interval for each criterion, one way is to calculate the center of the interval as a representative weight of criterion *j* as follows:

$$w_j^* = (min_{wj} + max_{wj})^2 \quad \text{(F.7)}$$

After finding the final results the consistency level of the comparisons should be calculated (Rezaei, 2015). A simple weighted average for each criterion and sub-criterion is computed from all the responses from the experts, to obtain a single weight vector (Rezaei et al., 2016). The consistency ratio of BWM can be expressed by using ξ^* and the corresponding consistency index (Table F.1), as follows:

$$Consistency\ Ratio = \frac{\xi^*}{Consistency\ Index} \quad \text{(F.8)}$$

Table F.1. Consistency index table. (source: (Rezaei, 2015))

a_{BW}	1	2	3	4	5	6	7	8	9
Consistency index	0.00	0.44	1.00	1.63	2.30	3.00	3.73	4.47	5.25

A comparison is fully consistent when $a_{Bj} \times a_{jW} = a_{BW}$ for all *j*, where a_{Bj}, a_{jW} and a_{BW} are respectively the preference of the best criterion over the criterion *j*, the preference of criterion *j* over the worst criterion, and the preference of the best criterion over the worst criterion. Consistency ratio ranges between 0 and 1. According to (Rezaei, 2015), the bigger the ξ^*, the higher the consistency ratio, meaning less reliable the comparison. However, it is possible for some *j* not to be fully consistent, therefore the consistency ratio means that the closer $\xi^{L*}$is to a zero value the more consistent the comparison system provided by the experts, while values close to 1 show less consistency (Rezaei et al., 2016). Finally, after the criteria and sub-criteria weights have been determined using BWM, the TOPSIS method can be applied to rate the best strategy.

Application of TOPSIS.

The TOPSIS can be summarized into the following steps (Dağdeviren et al., 2009; Kumar et al., 2020; Vanegas-López et al., 2021):

First, a decision matrix for ranking was constructed (where A_j denotates the strategic alternatives j, j = 1, 2, … J; F_i represents ith criterion, i = 1, 2, …, n, related to ith alternative; and f_{ij} is a crisp value indicating the performance rating of each alternative A_j with respect to each criterion F_j):

$$D = \begin{matrix} \\ A_1 \\ A_2 \\ \vdots \\ A_i \\ \vdots \\ A_j \end{matrix} \begin{bmatrix} F_1 & F_2 & \cdots & F_j & \cdots & F_n \\ f_{11} & f_{12} & \cdots & f_{1j} & \cdots & f_{1n} \\ f_{21} & f_{22} & \cdots & f_{2j} & \cdots & f_{2n} \\ \vdots & \vdots & \cdots & \vdots & \vdots & \vdots \\ f_{i1} & f_{i2} & \cdots & f_{ij} & \cdots & f_{in} \\ \vdots & \vdots & \cdots & \vdots & \vdots & \vdots \\ f_{J1} & f_{J1} & \cdots & f_{Jj} & \cdots & f_{Jn} \end{bmatrix} \tag{F.9}$$

In this step, experts rated the performance of each strategic alternative giving a crisp value within the range from 1–10 to represent the performance of each strategic alternative with respect to the sub-criteria.

Second is to normalize the data (Khorsandi & Li, 2022). To achieve normalization, each element in the matrix is divided by the square sum of the elements in the related column. The normalized value r_{ij} is calculated as follows:

$$r_{ij} = \frac{f_{ij}}{\sqrt{\sum_{j=1}^{n} f_{ij}^2}} = 1,2,\dots,J; i = 1,2,\dots,n. \tag{F.10}$$

Third, once the data is normalized, the next step is to calculate the weighted normalized decision matrix by multiplying the former by its associated weights. In order to achieve more accurate results, the BWM method was utilized, and the weights obtained from BWM were incorporated in this step. The weighted normalized value v_{ij} is calculated as follows (where w_i is the weight of the ith criterion):

$$V_{ij} = w_i \times r_{ij}, j = 1,2,\dots,J; i = 1,2,\dots,n. \tag{F.11}$$

Fourth is to determine the positive ideal (best) and negative ideal (worst) solutions using the following formulas (where I' is associated with beneficial criteria, and I'' is associated with non-beneficial criteria):

$$A^* = \{v_1^*, \dots\dots\dots, v_n^*\} = \{\left(\max j v_{ij} \middle| i \in I'\right), \left(\min j v_{ij} \middle| i \in I''\right)\} \tag{F.12}$$

$$A^- = \{v_1^-, \dots\dots\dots, v_n^-\} = \{\left(\min j v_{ij} \middle| i \in I'\right), \left(\max j v_{ij} \middle| j \in I''\right)\} \tag{F.13}$$

Fifth is to calculate the separation distances from the ideal best and ideal worst values. The separation of each alternative from the positive ideal solution is given as follows:

$$D_j^* = \sqrt{\sum_{i=1}^{n}(v_{ij} - v_i^*)^2}, j = 1,2,\dots,J. \quad \text{(F.14)}$$

Similarly, the separation of each alternative from the negative ideal solution is given as follows:

$$D_j^- = \sqrt{\sum_{i=1}^{n}(v_{ij} - v_i^-)^2}, j = 1,2,\dots,J. \quad \text{(F.15)}$$

Sixth is the calculation of the relative closeness of the alternative to the ideal solution and ranking of the performance order, which can be expressed as follows (where the CC_j^* index value lies between 0 and 1):

$$CC_j^* = \frac{D_j^-}{D_j^* + D_j^-}, j = 1,2,\dots,J. \quad \text{(F.16)}$$

The higher the score and the closer to 1 means the superior the performance of the alternative.

Paulius ŠŪMAKARIS

ECO-INNOVATION STRATEGIES
IN THE DEVELOPMENT OF INTERNATIONALIZATION

Doctoral Dissertation

Social Sciences,
Management (S 003)

EKOINOVACIJŲ STRATEGIJOS PLĖTOJANT
TARPTAUTINĮ VERSLĄ

Daktaro disertacija

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