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An Integrated Approach to Evaluating Eco-Innovation Strategies from the Perspective of Strategic Green Transformation: A Case of the Lithuanian Furniture Industry

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Abstract: Evaluation and selection of eco-innovation strategies is a significant and complex strategic decision, and despite the relevance and interest in the field of eco-innovation, the area of eco-innovation strategies has not been explored in depth in the scientific literature. Therefore, in this study, we propose an integrated approach to evaluating eco-innovation strategies from the perspective of strategic green transformation that helps decision-makers evaluate and select eco-innovation strategy aiming to achieve a competitive advantage. For this study, we adopted a validated multi-criteria decision-making methodology (MCDM) by combining Analytical Hierarchy Process (AHP) and The Technique for Order of Preference by Similarity to Ideal Solution (TOPSIS). The reliability of the proposed framework was tested and applied in the context of the Lithuanian furniture industry. This study offers three contributions and provides a comprehensive and profound insights into eco-innovation strategies. First, this study conceptualizes eco-innovation strategy from the perspective of strategic green transformation and proposed a novel definition and classification of eco-innovation strategies leading to competitive advantage. Second, this study proposes a novel approach to the evaluation of eco-innovation strategies taking into account micro-, meso-, and macro-level environmental factors. Third, the findings of this study provide implications for scholars and decision-makers in the field of eco-innovation strategy and set an agenda for future research.

Keywords: eco-innovation; eco-innovation strategy; strategic green transformation; strategy selection; strategic decision-making; competitive advantage; sustainable development; multi-criteria decision-making (MCDM)

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1. Introduction

In recent years, the consequences of economic development on the environment and the growing impact of climate change on our daily lives have become the issues of global interest [1]. Environmental issues such as air, water, noise or soil pollution, waste, and carbon footprints resulting from economic production activities are becoming more and more important [2]. Environmental concerns and supply chain-related disruptions due to the COVID-19 pandemic have prompted countries around the world to adapt quickly. The direct impact of the COVID-19 pandemic on the manufacturing sector [3], as well as the economic uncertainty, due to the suspension of most economic activities, has increased the importance of eco-innovation and carbon reduction at the global political level [4]. Moreover, recent geopolitical, economical, and socio-environmental crises have shifted initiatives of governments to more focused environmental protection issues, speeding up the nascent sustainability transformation [5]. To address environmental challenges, most OECD countries at the political level have recognized eco-innovation as a key tool in preventing a negative impact on the environment and are seeking to promote innovations which increase the usage of renewable resources, environmental protection, control pollution, regulate waste management, etc. [6]. Most importantly, the manufacturing sector is considered not only one of the main polluters and a threat to environmental sustainability [7], but also as one of the main drivers of eco-innovation [8]. Within such context, companies can not only cause environmental problems, but also solve them [9] by adopting more environmentally friendly products and processes to reduce the negative environmental impacts. In particular, eco-innovation generates a "win-win" setup characterized by the compatibility of economic development and a sustainable economy [10]. Therefore, the green transformation of the manufacturing sector is a global priority.

For this reason, companies must integrate environmental responsibility into their long-term strategies [11], as the strategies adopted by companies have a direct effect on the environment. Such an approach to sustainable development through the promotion and adoption of eco-innovation has opened new horizons for the establishment of new competitive rules in business practice. Companies are being pressured to compete in multiple dimensions and not only satisfy environmental needs and comply with environmental regulations, but also differentiate themselves from their competitors and gain sustainable competitive advantage [12]. Firms that dedicate their strategy, resources, capabilities, culture and knowledge to eco-innovation meet the environmental requirements and create barriers to competitors, improve company production efficiency, and expand to new markets [13]. Therefore, to be successful in competitive markets, companies must adapt to increasing environmental awareness, growing consumer demand, and world-wide regulations for environmentally friendly products and processes [14] by integrating environmental problems at the strategic level and adopting environmentally friendly business strategies, making eco-innovation imperative and not a choice [15]. As a result, in contemporary business practice, eco-innovations become one of the most important strategic tools in gaining sustainable competitive advantage [16]. Consequently, based on the above presented significance of eco-innovation, in this study we refer to the competitive advantage as the main outcome of eco-innovation strategy and strategic green transformation. Moreover, we adopt the view towards competitive advantage [17], which includes both financial indicators (i.e., sales, profit, market share, return on sales, growth, etc.) and non-financial indicators (customer satisfaction, customer loyalty, company reputation, etc.).

However, the evaluation and selection of eco-innovation strategies is a significant and complex strategic decision. Despite the relevance and interest in eco-innovation, the area of eco-innovation strategies has not been explored in depth in the scientific literature and the general nature of eco-innovation strategies remains complex and unclear [18]. According to Shukla, 2019 [19], the literature lacks a consensus on the common theoretical framework relevant to the eco-innovation strategy. There is a shortage of studies on the phenomenon of eco-innovation from an organizational management and strategic perspective [20]. Scholars investigate eco-innovation from the process and product perspective [11] and refer to isolated practices [20]. Furthermore, studies investigating eco-innovation as a strategy are very fragmented and neglect the ambidexterity of eco-innovation [11]. Therefore, the literature did not address and investigate eco-innovation from the strategic perspective and strategic decision-making perspective of the firm, and no scientific evidence is provided to distinguish strategic and the operational decisions [21]. Finally, there are no decision-making models integrating micro-, meso-, and macro-level environmental indicators relevant for decision-makers focused on implementation of eco-innovation strategy.

This study attempts to fill this research gap and the aim of this study is to propose an integrated approach to the evaluation of eco-innovation strategies from the perspective of strategic green transformation of manufacturing firms in order to achieve a competitive advantage. The main research questions of the present study are formulated as follows. RQ1—What are the relevant criteria and sub-criteria for implementing an eco-innovation strategy, and how do they impact the strategic decision-making? RQ2—What are the rankings and importance of each criterion and sub-criterion in the strategic decision for implementing eco-innovation strategy? RQ3—What are the rankings of eco-innovation strategy alternatives for the Lithuanian furniture industry? To address these research questions, using multi-criteria decision-making methodology (MCDM), this study proposes a strategic management framework suitable for the decision-makers aiming to evaluate and select eco-innovation strategy. The reliability of the proposed framework was tested and applied in the context of the Lithuanian furniture industry.

This study offers three contributions and provides a comprehensive and profound insight into eco-innovation strategies. First, this study conceptualizes the eco-innovation strategy from the perspective of strategic green transformation and proposes a novel definition and classification of eco-innovation strategies. Second, this study proposes an integrated approach to the evaluation of eco-innovation strategies and the strategic green transformation of the manufacturing firm taking into account micro-, meso-, and macro-level environment factors that help decision-makers evaluate and select eco-innovation strategy. Third, this study provides insights into the factors that affect strategic decisions to implement eco-innovation strategy and sets an agenda for future research. To the best of our knowledge, this is the first study that considered eco-innovation strategy from the perspective of strategic green transformation of the firm. This study makes a significant contribution to the literature on eco-innovation strategy from the firm-level and decision-making perspectives.

This article is structured as follows. Section 2 presents theoretical background and Section 3 presents the methodology and step-by-step explanation of this study. Section 4 presents the results of the real-world case application of the proposed framework. Section 5 presents a discussion, and the final section concludes and suggests implications for scholars and decision-makers. Finally, the future research agenda is highlighted.

2. Theoretical Background

2.1. Strategic Approach to Eco-Innovation and Defining Eco-Innovation Strategy

Strategic management discipline originated in the 1960s [22] and according to one of the most prominent contributors to the field, Chandler, 1962 [23] (p. 13), a strategy can be defined as "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". However, the area of eco-innovation strategies has not been explored in depth and the general nature of eco-innovation strategies remains complex and unclear [18,19]. First, the "eco" in the "eco-innovation" is based on the "traditional innovation with a reduction in environmental impact" [24] and any innovation could be an eco-innovation as long as it is more environmentally friendly than the relevant alternative [25]. Second, following previous studies [26,27], this study further refers to "eco" and "green" as similar terminologies, and this study further assumes that eco-innovation is an intersection between economic and environmental innovation and that both dimensions are essential when considering eco-innovation strategy.

However, when it comes to the strategic decision of the firm to implement eco-innovation as well as the strategic green transformation of the firm, it is not that straightforward. The scientific literature interrelates the definitions and measures of environmental (or green, ecological, and sustainable) strategy with eco-innovation strategy [9,28–30]. The most influential studies that were adopted in further researches and snowballed the investigations on eco-innovation strategy are conducted by Chan, 2005 [31], who drawing upon a natural-resource-based view of the firm proposed the construct for measuring environmental strategy and by Eiadat et al. 2008 [32], who proposed the first definition of eco-innovation strategy and newly created scale. Though both studies had a major influence in the field of eco-innovation strategy, the need to have a distinct concept and evaluation tools of eco-innovation strategy distinguished from environmental strategy remains.

In general, two perspectives emerge in the scientific literature on eco-innovation strategy studies. First, eco-innovation strategy is considered as a proactive environmental strategy when eco-innovations are recognized as a tool to implement an environmental strategy of the firm [11,17,33,34]. Few authors refer to proactive environmental (or sustainable) strategy [35–37] as a strategy which embodies the organization's strategic orientation rather than tactical approach to eco-innovation. However, this study argues that eco-innovation strategy essentially differs from environmental strategy. In addition, eco-innovation strategy is based on a fundamental principle of strategic green transformation and increasing competitive advantage, and includes both economic and environmental dimensions, while studies on environmental strategy consider environmental performance of a firm as an expected outcome. Second, eco-innovation strategy is considered as a green strategic orientation [38,39] or a research and development (R&D) strategy with environmental orientation and as a source of green organizational identity, eco-innovation and green creativity [28,40,41]; green learning and knowledge sharing [2,9]; green intellectual capital [38], etc.

However, the environmental orientation of the firm or the R&D strategy with environmental orientation should not be equated with eco-innovation strategy. Empirical evidence confirms that R&D expenditures do not always or immediately improve firm's competitive advantage or performance [34,42–46]. First, R&D activities require significant investments, and even companies that invest significantly in internal R&D activities more than often rely on cooperation with external partners to diversify risks or gain access to competencies [47,48]. Typically, more radical eco-innovations require more fundamental R&D activities [48]. Most, certainly not all manufacturing companies, especially small and medium-sized enterprises, possess such resources. Companies have resource constraints and can face difficulty in developing eco-innovations. Therefore, implementing prevailing and standard eco-innovations can help companies with the strategic green transformation [49]. Second, R&D is a highly risky activity [50] and does not provide guarantees for a competitive advantage as compared to adopting and implementing eco-innovations that are already developed by external partners. Therefore, this study argues that by approaching eco-innovation strategy from the perspective of adoption of eco-innovation rather than R&D, the firm is able to manage resources and risk. Moreover, the adoption of new processes or business practices that are developed elsewhere (mainly by external partners) is still considered as innovation [25]. Therefore, this study stresses the importance of eco-innovation adoption (i.e., implementing eco-innovations that already exist) as compared to the development of eco-innovation when it comes to green strategic transformation, resources, and risk management.

To conceptualize eco-innovation strategy, this study follows the reasoning based on study by Walton et al. 2020 [51] on organizational strategic capabilities, which affect eco-innovations, and argues that strategic approach to eco-innovation essentially differs from the non-strategic approach, in that the former requires the following (1) a strategy of continuous improvement in the firm, and (2) to integrate eco-innovation across the whole firm so that the outcome is to have a system-level change at the firm level [51]. Therefore, isolated eco-innovation practices, such as environmental management systems or new and more environmentally friendly product changes alone, are not equated with the eco-innovation strategy. Furthermore, Walton et al. 2020 [51] argues that isolated eco-innovation practices does not generate competitive advantage. Contemporary strategic management of eco-innovation has shifted from selecting the best eco-innovation practices, characterized by rankings and competitiveness, to selecting a set of eco-innovation solutions that best meets the firm's strategic goals to deliver future benefits [21]. Therefore, approaching eco-innovation from a non-strategic perspective, as well as a failure to evaluate and select an appropriate eco-innovation strategy, may result in long-term negative consequences, such as losing valuable resources, customers, competitiveness, ineffective expenditure on isolated and non-synergetic eco-innovation practices that are widely spread throughout the firm, and eventually diminished organizational performance and reputation [52].

When it comes to defining the eco-innovation strategy, the existing definitions are very limited, often overlap with the environmental strategy of an organization, and do not cover an entire area of the strategic approach to eco-innovation. The definitions of eco-innovation strategy are presented in Table 1.

Table 1. The definitions of the eco-innovation strategy.

Reference	The Definition of the Eco-Innovation Strategy
[32]	Eco-innovation strategy is defined as a class of manufacturing practices that include source reduction, pollution prevention, and the adoption of an environmental management system.
[53]	Eco-innovation strategy refers to 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.
[17]	Eco-innovation strategy refers to 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.
[54]	Eco-innovation strategy is the decision-making executed by a firm in the scope of environmental benefits to react to the changing reality (e.g., environmental pressures).
[18]	Eco-innovation strategy means a set of actions and commitments by manufacturing firms for realizing innovation that targets and boosts sustainable development.
[55]	Eco-innovation strategy is described as 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.

The above presented definitions let us suggest that there is a necessity to have a distinct definition of eco-innovation strategy that is distinguished from environmental strategies with the intended outcome of improving both the environmental and economic performance of organization. Therefore, this study argues that when defining eco-innovation strategy from the perspective of strategic green transformation of the firm, it is essential to include components such as strategic decision-making; continuous improvement; integration of a set of eco-innovations throughout the firm so that the outcomes have a system-level change at the firm level; as well as both environmental and economic benefits. Therefore, in this study we propose a novel definition of eco-innovation strategy as follows: 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. Based on the proposed definition of eco-innovation strategy with the main emphasis on continuous improvement and integration of a set of eco-innovation practices across the whole firm which specifically targets the green transformation of products or processes of manufacturing firms, the next Sub-Section presents the identification and analysis of eco-innovation strategy alternatives followed by factors that affect the strategic decision.

2.2. Classification of Eco-Innovation Strategy Alternatives

In this sub-section we propose a classification of eco-innovation strategy alternatives and briefly explain the reasoning behind the proposed classification of eco-innovation strategies with the main emphasis on the strategic green transformation of products or processes of organization, aiming for a competitive advantage.

Empirical studies on eco-innovation have successfully adopted generic competitive strategies proposed by Porter, 1985 [56], i.e., cost-leadership and differentiation [20,35,57–59]. However, despite the vast interest in eco-innovation and competitive advantage, to the best of our knowledge, so far no one has classified eco-innovation strategies from the perspective of strategic green transformation of manufacturing firms through the implementation of a set of eco-innovations across the whole firm to enhance the competitive advantage of the firm. Therefore, following this line of research and with the opinions of field experts, in this study we propose a classification of four mutually exclusive and collectively exhaustive eco-innovation strategies that are based on generic competitive strategies proposed by

Porter, 1985 [56] with a novel approach to strategic green transformation for a competitive advantage as follows:

1. Eco-innovation process cost leadership strategy, which is conceptualized as follows: a strategic green transformation of the internal processes of the organization through the implementation of a set of eco-innovations. The strategy is related to increased operation efficiency and more efficient logistics, operations, marketing and sales, services, supporting activities such as maintenance systems or operations for purchasing, accounting, or computing through eco-process innovation.
2. Eco-innovation product cost leadership strategy, which is conceptualized as follows: a strategic green transformation of the products of organization through the implementation of a set of eco-innovations. The strategy is related to minimizing general costs and reducing material and energy resources through eco-product innovation related to product design, packaging, introduction of substitutes, etc.
3. Eco-innovation process differentiation strategy, which is conceptualized as follows: a strategic green transformation of the internal processes of organization through the implementation of a set of eco-innovations. The strategy is related to brand image differentiation through eco-process innovation that reduces air, water, noise, or soil pollution, replaces fossil energy with renewable energy sources, achieves environmental certificates, eco-labels, or green awards, and creates a distinct green organization brand image for customers.
4. Eco-innovation product differentiation strategy, which is conceptualized as follows: a strategic green transformation of the products of organization through the implementation of a set of eco-innovations. The strategy is related to product transformation through eco-product innovation, by adding additional environmental dimensions to the product, such as recyclable packaging, biodegradable construction, toxic-free materials, etc.

Eco-innovation cost leadership strategies arise from the strategic green transformation of the processes or products of the company through the implementation of a set of eco-innovation to reduce energy, materials, and taxation, and to increase company efficiency and to minimize costs for the end-customer. On the contrary, the importance for the firm to differentiate itself from competitors is one of the key factors for adopting environmental eco-innovation (i.e., eco-innovations that reduce externalities) [10,35,57–60]. Therefore, eco-innovation differentiation strategies arise from the strategic green transformation of the process or product and eco-innovations that reduce externalities such as air, water, noise, soil pollution, and harmful materials, and/or innovation that facilitated the recycling of the product after use and/or extended product life to create a distinct green organization or green product brand image for the customers.

The classification is in line with the previously proposed definition of eco-innovation strategy, with the main emphasis on continuous improvement and integration of a set of eco-innovation practices across the whole firm that specifically targets the transformation of products or processes of an organization.

2.3. Criteria Set for the Evaluation and Selection of Eco-Innovation Strategy

The evaluation and selection of eco-innovation strategies is a complex process, and such strategic decision involves various multi-level aspects and depends on different factors [61]. Since very little research has been completed to classify the criteria for the evaluation of the eco-innovation strategy alternatives, based on the methodology presented in Section 3, in this study, we classify the criteria and sub-criteria into the following: (1) micro-level environment (resources and capabilities), (2) meso-level environment (market dynamics), and (3) macro-level environment (environmental regulation and taxes and public financial support). The description of each sub-criterion for the evaluation of eco-innovation strategy alternatives is presented in Table A1 (Appendix A), and Section 2.3.1, Sections 2.3.2–2.3.4.

2.3.1. Micro-Level Environment: Resources and Capabilities (A)

Employee pressure (A1) and attitudes towards environmental issues and eco-innovation are a significant factor when considering the decision to implement the eco-innovation strategy [62]. Employees are often the initiators and pressure the organization to adopt environmental protection practices, thus firms face difficulties in implementing the eco-innovation strategy without the support of employees [63,64].

Managerial environmental concern (A2) is perhaps the strongest determinant of eco-innovation strategy [32]. Managers, who are environmentally concerned, pay greater attention to the environment and are more enthusiastic about adopting eco-innovations [65]. Top-level management is the driving force behind organizational change, and the eco-innovation strategy is a major change that requires continuous support, commitment and coordination [57].

Financial resources (A3) of the company and overall financial health are very important when considering the decision to implement the eco-innovation strategy [66]. Financial barriers and poor financial performance of the company are a deterrent for the implementation of the eco-innovation strategy [67,68]. The company with limited financial resources may not allocate funds to green transformation or secondary aspects of the firm's main activities [68]. Therefore, firms with better financial health are more likely to invest in eco-innovation strategies.

Environmental absorptive capacity (A4) refers to the company's ability to obtain, understand, integrate, alter and exploit environmental knowledge [69] and plays a key role in the implementation of the eco-innovation strategy [70,71]. The companies with a high environmental absorptive capacity are more alert and recognize the environmental pressures, are able to acquire knowledge from external partners, and to combine it in novel ways with their existing knowledge [71].

Environmental dynamic capabilities (A5) refer to the company's ability to utilize its existing resources and knowledge for transformation related to environmental protection [69] and are considered as major factor for the successful implementation of the eco-innovation strategy [72,73]. The environmental dynamic capabilities allow the firm to deploy resources and quickly adapt to the changes required to deal with the environmental issues [72].

2.3.2. Meso-Level Environment: Market Dynamics (B)

Customer demand for environmental products (B1) is considered as one of the main reasons that justify the implementation of eco-innovation strategy [74]. Companies implement eco-innovation strategy aiming to differentiate products from competitors and monetize their environmental investments [75]. Typically, customers demand environmental products that not only comply, but also exceed regulatory requirements [76].

Customer demand for environmental production processes (B2) and the overall environmental responsibility of the company are considered as one of the main forces that pressure companies to implement eco-innovation strategy [77,78]. When environmentally conscious customers demand clean production processes, companies can adapt and fulfill the demand, becoming more environmentally friendly, or ignore the demand and lose their customers [65].

Competitive intensity level (B3) and pressure from competitors as well as "how green are the competitors" are key factors that need to be taken into consideration when considering the implementation of the eco-innovation strategy [63,78]. Competitive pressure triggers companies to implement eco-innovation strategy to improve their market position [65] and in a highly competitive environment, customers are confronted with a multitude of choices, thus one of the ways to differentiate and to establish a green image is through the eco-innovation strategy [57,74].

Supplier pressure (B4) to adapt to changes in supplier's environmental products or processes must be considered when considering the decision to implement the eco-innovation strategy. Companies that cooperate closely with suppliers are more likely to implement eco-innovation practices [79]. By integrating business processes with downstream and upstream suppliers, companies can achieve environmental objectives and alleviate pressure on the requirements of buyers [80] as well as improve firms' innovation performance [81].

Social pressure (B5) that managers face from non-market stakeholders such as media, nongovernmental organizations, environmentalists, and other stakeholders for the overall environmental responsibility of the company influences the decision to implement the eco-innovation strategy [82,83]. Social pressure makes companies more sensitive to ecological issues [57] and to behave accordingly [82].

Environmental innovativeness within industry (B6) can be considered one of the main determinants of eco-innovation activities [84], and it is crucial to evaluate when considering the decision to implement the eco-innovation strategy. Kruse and Wetzel, 2016 [84] suggests that eco-innovation is triggered by technological advances in an industry (referring to the technology-push hypothesis). Moreover, the intensity of industry pollution creates a bad reputation for poor environmental performance and could damage relations with regulators and other important social actors [85,86].

2.3.3. Macro-Level Environment: Environmental Regulation and Taxes (C)

Existing environmental regulations (C1) for environmental protection, pollution, waste management, etc. play a key role in the promotion of environmental actions [87] and affect the firm's decision to implement the eco-innovation strategy [63,82]. Promotion of eco-innovation through regulatory measures and the degree to which the government enforces the regulations has a significant impact on the approach of companies to environmental protection [63,88].

Existing environmental taxes, charges, or fees (C2) for the company's negative environmental impact can affect the firm's decision to implement eco-innovation strategy. Taxation limits company profitability and forces the company to pay CO_2 and other taxes [89]. Most environmental taxation instruments aim to reduce emissions; thus, it can encourage firms to invest in the eco-innovation strategy [89,90].

Environmental regulations or taxes expected in the future (C3) may be the reason to invest in the eco-innovation strategy [91,92] and can pressure companies to be more proactive in the decision to implement eco-innovation strategy [54]. The lack of specific laws or codes to comply with anticipated regulations may motivate firms to increase their scope of eco-innovation [54].

2.3.4. Macro-Level Environment: Public Financial Support (D)

Public financial support (D1–D4) that helps to reduce the negative environmental impact, such as subsidies, subsidized loans, loan guarantees, and green-related tax relief affects the firm's decision whether to invest in the eco-innovation strategy [90,93,94]. Previous studies [87,93,94] classified external financial support by considering three institutional levels: (1) local or regional authorities (D1); (2) national governments; (3) other financial support from the European Union institutions (D4). However, following the Community Innovation Survey (CIS) 2020 and field experts' opinions, an additional fourth level was added: Financial support from Horizon Europe Programme for Research and Innovation (D3).

The summarized criteria set with a total of 4 criteria and 18 sub-criteria for the evaluation of eco-innovation strategy alternatives is presented in Table 2.

The criteria set with eco-innovation strategy alternatives are further used in the multi-criteria decision-making method for the evaluation and selection of the best eco-innovation strategy.

Table 2. Criteria Set for the Evaluation of Eco-Innovation Strategies.

Criteria (Label)	Sub-Criteria (Label)	Reference
Resources and Capabilities (A)	Employee pressure (A1)	[62–64]
	Managerial environmental concern (A2)	[32,57,65,83]
	Financial resources (A3)	[66–68]
	Environmental absorptive capacity (A4)	[69–71]
	Environmental dynamic capabilities (A5)	[69,72,73,95]
Market dynamics (B)	Customer demand for environmental products (B1)	[74–76]
	Customer demand for environmental production processes (B2)	[65,77,78]
	Competitive intensity (B3)	[57,63,65,74,78]
	Supplier pressure (B4)	[79–81]
	Social pressure (B5)	[57,82,83]
	Environmental innovativeness within industry (B6)	[84–86]
Environmental regulation and taxes (C)	Existing environmental regulations (C1)	[63,82,87–89]
	Existing environmental taxes, charges or fees (C2)	[88–90]
	Environmental regulations or taxes expected in the future (C3)	[54,91,92]
Public financial Support (D)	Financial support from local or regional authorities (D1)	[87,93,94]
	Financial support from national government (D2)	[87,88,93,94]
	Financial support from Horizon Europe Programme for Research and Innovation (D3)	CIS 2020
	Other financial support from a European Union institution (D4)	[87,93,94]

3. Research Method

In this study, we propose an integrated approach for evaluation of eco-innovation strategies by adopting a validated multi-criteria decision-making methodology from previous studies [96–102] by combining Analytical Hierarchy Process (AHP) and The Technique for Order of Preference by Similarity to Ideal Solution (TOPSIS). Multiple previous studies have already applied a wide range of MCDM approaches in the field of strategy selection and eco-innovation (Table 3).

Table 3. Summary of previous studies on eco-innovation and strategy selection methods.

Reference	Methodology	Application Goal
[7]	Fuzzy AHP, Fuzzy TOPSIS	For analysis of the eco-innovation practices based on sustainability performance indicators
[103]	AHP	For evaluation of critical factors in implementation of the eco-innovation
[104]	AHP and OVP	For evaluation of eco-innovation abilities
[105]	AHP	For manufacturing strategy selection
[106]	AHP, SOWIA and TOPSIS	For selection of the supply chain strategy for sustainable development
[107]	Entropy weighted TOPSIS	For ecological-economic efficiency evaluation of eco-innovation

Table 3. *Cont.*

Reference	Methodology	Application Goal
[108]	Fuzzy AHP, Fuzzy TOPSIS	For driver's evaluation for implementation of eco-innovation
[109]	Fuzzy AHP, Fuzzy TOPSIS	For supplier selection for the adoption of eco-innovation
[110]	Fuzzy Delphi and DEMATEL	For evaluation of innovation capabilities of real estate firms

However, to the best of our knowledge, this is the first study that applied AHP-TOPSIS for the selection of eco-innovation strategy. Combined AHP-TOPSIS have been extensively utilized in multi-attribute decision-making and the benefits of this combined method are that it is very versatile and can be adapted to include value judgments of individual or multiple decision-makers [98,100]. Therefore, a combined AHP-TOPSIS was selected for this study due to the ability of the AHP method to handle larger problems and the ability of the TOPSIS method to clearly interpret the absolute evaluation of every alternative.

The integration of both MCDM has been accomplished by using criteria and sub-criterion weights obtained from AHP analysis and incorporated into TOPSIS to rank the best eco-innovation strategy alternative. This use of the MCDM not only provides a framework for making strategic decisions but, more importantly, a framework for thinking and discussing strategic decisions [111].

The illustrated schematic diagram of the research methodology for the evaluation and selection of eco-innovation strategy is presented in Figure 1. The reliability of the proposed framework was tested and applied in the context of the Lithuanian furniture industry. Eight field experts from the Lithuanian furniture industry were involved in the research and the demographics data of the experts is presented in Table A2 (Appendix B). For the identification of the experts, we followed procedure presented by [112]. Wagner et al. 2010 [112] (p. 30), stating that experts "should be selected based on their knowledge and do not have to be representative in any statistical sense". However, most authors indicate that such research should include no less than three experts and the saturation of knowledge might be ensured with more than five experts [113,114]. Following the previous study [113], the non-probability sampling strategy was chosen for this study and the experts were selected if they meet the following criteria: (1) the expert currently occupies a managerial position in a company, operating in the Lithuanian furniture industry; (2) the size of represented company is not smaller than a medium-sized enterprise; (3) the expert has at least 10 years of experience in a top-level management position; (4) the expert has competencies related to changes in the company through the implementation of eco-innovation; (5) the expert has competencies related to the implementation of strategic changes in the company. Expert recruitment and surveying were carried out in February 2023, through business associations and professional networks.

In this study, aiming to identify and select criteria and sub-criteria for the evaluation of eco-innovation strategy and to formulate and classify eco-innovation strategy alternatives, extensivse literature analysis was conducted and empirical studies were identified and collected from the Web of Science database (WoS). First, based on the proposed definition of the eco-innovation strategy in this study and following the guidelines of [115–117], the criteria and sub-criteria that are important in the strategic decision-making process for evaluating and selecting eco-innovation strategy were identified and analyzed.

Second, to complete a reliability check and bridge the gap between researchers and practitioners, eight field experts from the Lithuanian furniture industry were involved in the process for formulation of the effective and practical eco-innovation strategy alternatives; selection and classification of criteria and sub-criteria for the evaluation of the eco-innovation strategy alternatives; the design of the decision hierarchy model; weighing and assessment for importance of each criteria and sub-criteria in the paired comparisons, as well as rating the performance of each strategic alternative with respect to each sub-criterion. To select and classify criteria and sub-criteria for the evaluation of eco-innovation strategy alternatives, experts were presented with the results of the literature analysis and following the guidelines of previous studies [110,118,119], several rounds of discussions with field experts followed. The application of AHP-TOPSIS followed, which is presented in Sections 3.1 and 3.2.

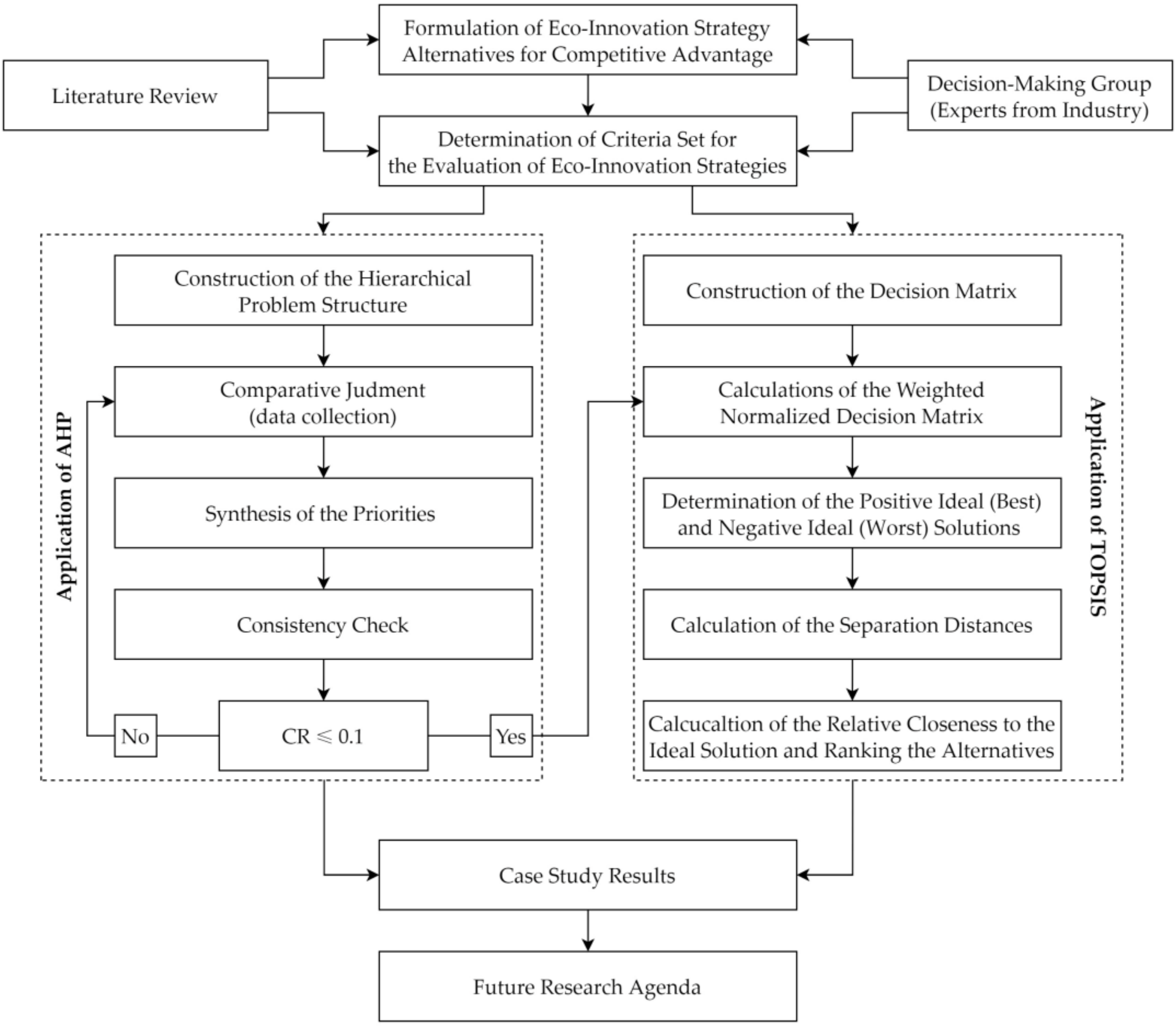


Figure 1. Research Methodology Framework for the Evaluation and Selection of Eco-Innovation Strategy (developed by authors according to [96–102]).

3.1. Application of AHP

AHP is one of the fundamental methods of MCDM [102], and it is extensively utilized to solve multi-faceted and complex decision-making problems [49]. The AHP allows decision-makers to evaluate and prioritize complex problems that involve multiple criteria. It uses a systematic and structured approach to analyze and make decisions based on subjective judgment and trade-off between conflicting criteria [120]. The AHP determines priority weights for alternatives by organizing strategic decision goal, criteria, and sub-criteria in a hierarchic structure [120,121].

The application of the AHP is mainly based on three steps [96,102,122]. In the first step, a complex decision problem is structured as a hierarchy, which breaks down a complex decision problem into a hierarchical problem structure with (1) goal of the problem; (2) criteria; (3) sub-criteria; (4) strategic alternatives. Based on extensive literature analysis and the opinions of field experts (Section 2), eco-innovation strategy alternatives (n = 4) were formulated and criteria (n = 4) and sub-criteria (n = 18) that affect the strategic decision were classified for the evaluation and selection of the best eco-innovation strategy. The hierarchical problem structure is presented in Figure 2.

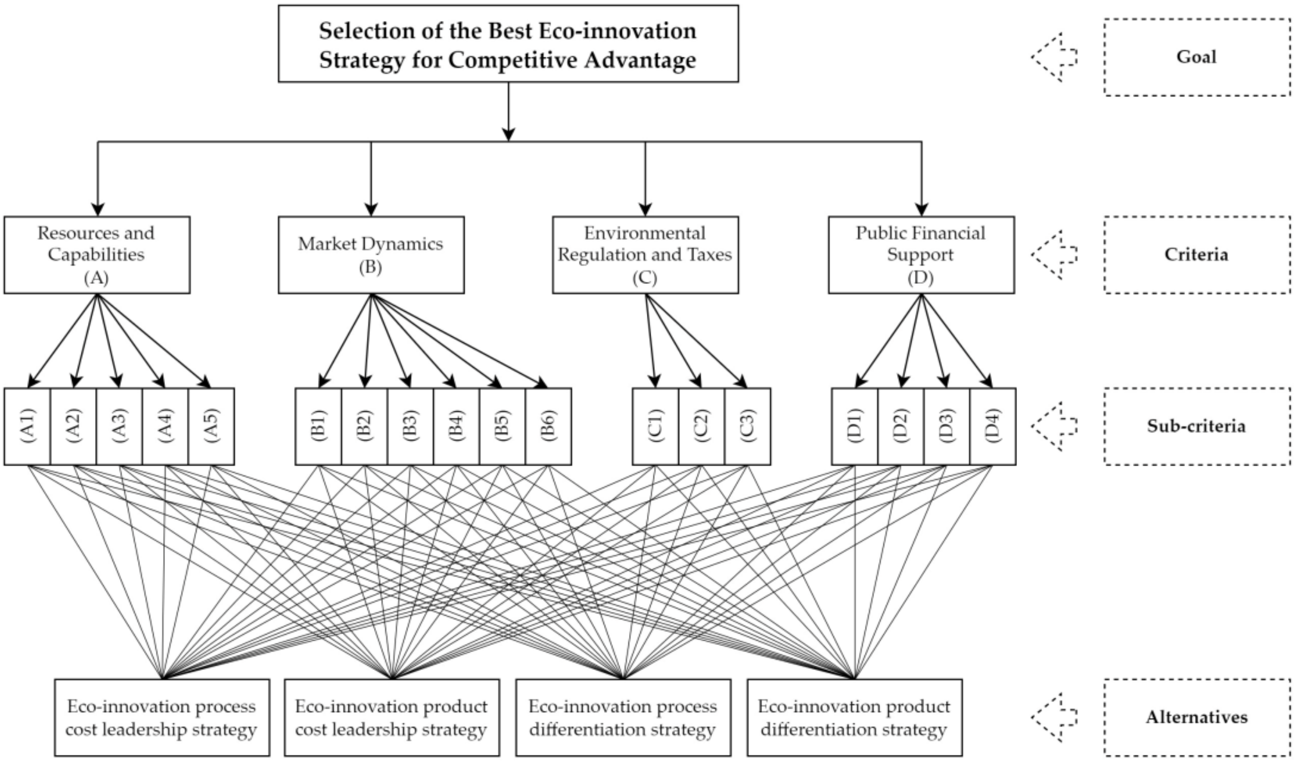


Figure 2. The Hierarchical Problem Structure of This Study.

In the second step, a pairwise comparative judgment is conducted when the field experts made pairwise comparisons based on their experience to determine the relative importance of each sub-criterion compared with another. At each level, the criteria and sub-criteria are compared in pairs based on their levels of influence and on the specified criteria at the higher level [122]. Pairwise comparison enable experts to entirely focus on two criteria or sub-criteria that are being compared [102]. A n × n pairwise comparison matrices were constructed using criteria set described in Section 2.3 (Table 2), where n denotes the number of criteria or sub-criteria under assessment in which every element a_{ij} (ij = 1, 2, . . . , n) is the quotient of weights of the criteria, as shown:

$$A = \begin{bmatrix} a_{11} & a_{12} & \cdots & a_{1n} \\ a_{21} & a_{22} & \cdots & a_{2n} \\ \cdots & \cdots & \ddots & \vdots \\ a_{n1} & a_{n2} & \cdots & a_{nn} \end{bmatrix},\ a_{ii} = 1,\ a_{ji} = \frac{1}{a_{ij}},\ a_{ji} \neq 1 \quad (1)$$

The pairwise comparison is conducted by asking experts questions such as which criterion or sub-criterion is more important with respect to the strategic green transformation and the implementation of the eco-innovation strategy, and the comparison is made according to a standard and straightforward 1–9-point scale (Table 4).

Table 4. Meaning of scale.

Relatively Importance	Scale	Relatively Importance	Scale
Equally important	1	Equally important	1
Moderately important	3	Moderately less important	1/3
Strongly important	5	Weakly important	1/5
Very strongly important	7	Very weakly important	1/7
Extremely important	9	Extremely weak	1/9
Intermediate values	2, 4, 6, 8	Intermediate reciprocal values	1/2, 1/4, 1/6, 1/8

In the third step, the synthesis of the priorities is performed, to normalize each matrix [122]. The normalization procedure of the pairwise comparison matrix was carried out as follows: (a) calculation of the sum of every column; (b) division of every member of the matrix, respectively, by its obtained column sum; (c) averaging of the rows to obtain relative weights. The quality of the AHP is rigorously dependent on the consistency of the pairwise comparison judgments [122]; thus, the derived weights need to pass a consistency test [102], by calculating the consistency index (CI) and the consistency ratio (CR). The consistency is defined by the relation between the entries of A: $a_{ij} \times a_{jk} = a_{ik}$. The consistency index (CI) is:

$$\mathrm{CI} = \frac{\lambda\mathrm{max} - \mathrm{n}}{\mathrm{n} - 1} \quad (2)$$

The CR is calculated as the ratio of the CI and the random index (RI) (Table 5), as indicated:

$$\mathrm{CR} = \frac{\mathrm{CI}}{\mathrm{RI}} \quad (3)$$

Table 5. Random index (RI) values for different matrix sizes.

n	1	2	3	4	5	6	7	8	9	10
RI	0	0	0.58	0.90	1.12	1.24	1.32	1.41	1.45	1.49

The acceptable range of the CR value is ≤0.1 [97,99,101]. If the final CR value is greater than 1, the evaluation procedure has to be repeated [122]. The measurement of consistency is used to judge the consistency of the overall hierarchy structure and the consistency of decision-makers' judgement [122].

Finally, the quantitative results of the importance of criteria and sub-criteria given by an expert from the case industry a TOPSIS method can be applied to aggregate these judgments. TOPSIS is one of the traditional methods for solving MCDM-based decision-making problems.

3.2. Application of TOPSIS

In this study, TOPSIS is used to rank strategic alternatives. TOPSIS is one of the traditional methods for solving MCDM-based decision-making problems and is based on the simple and intuitive principle [101]. TOPSIS calculates the shortest distance from the ideal (best) solution and the farther distance from the ideal (worst) solution [101]. TOPSIS is very useful to solve problems in which the contribution and the performance of each criteria is precisely rated by decision-makers [108].

The TOPSIS can be summarized into the following steps [96,97,99,100,122]:

First, a decision matrix for ranking was constructed (where A_j denotates the strategic alternatives j, $j = 1, 2, \ldots J$; F_i represents ith criterion, $i = 1, 2, \ldots, n$, 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):

$$D = \begin{matrix} A_1 \\ A_2 \\ \vdots \\ A_i \\ \vdots \\ A_j \end{matrix} \begin{bmatrix} F_1 & F_2 & \cdots & F_j & \cdots & F_n \\ f_{11} & f_{12} & \cdots & f_{1j} & \cdots & f_{1n} \\ f_{21} & f_{22} & \cdots & f_{2j} & \cdots & f_{2n} \\ \vdots & \vdots & \cdots & \vdots & \vdots & \vdots \\ f_{i1} & f_{i2} & \cdots & f_{ij} & \cdots & f_{in} \\ \vdots & \vdots & \cdots & \vdots & \vdots & \vdots \\ f_{J1} & f_{J1} & \cdots & f_{Jj} & \cdots & f_{Jn} \end{bmatrix} \quad (4)$$

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 18 sub-criteria. In addition to sub-criteria, auxiliary questions for experts were provided, for instance: Environmental dynamic capabilities (A5)—How effectively can our environmental dynamic capabilities be used for each strategy? (when 1—ineffectively and 10—highly effectively); Supplier pressure (B4)—How high is the supplier pressure to implement each strategy? (when 1—very low pressure and 10—very high pressure); Competitive intensity (B3)—How likely would each strategy let us gain an upper hand against competitors? (when 1—very unlikely and 10—very likely); Financial support from national government (D2)—How accessible is the financial support from the national government with respect to each strategy? (when 1—not accessible and 10—highly accessible), etc.

Second is to normalize the data [101]. 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:

$$r_{ij} = \frac{f_{ij}}{\sqrt{\sum_{j=1}^{n} f_{ij}^2}} = 1, 2, \ldots, J; i = 1, 2, \ldots, n. \quad (5)$$

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, we have utilized the AHP method, and the weights obtained from AHP analysis 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):

$$V_{ij} = w_i \times r_{ij},\ j = 1, 2, \ldots, J; i = 1, 2, \ldots, n. \quad (6)$$

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):

$$A^* = \{v_1^*,\ \ldots\ldots\ldots,\ v_n^*\} = \left\{ \left(\max j v_{ij} \middle| i \in I'\right),\ \left(\min j v_{ij} \middle| i \in I''\right) \right\} \quad (7)$$

$$A^- = \left\{v_1^-,\ \ldots\ldots\ldots,\ v_n^-\right\} = \left\{ \left(\min j v_{ij} \middle| i \in I'\right),\ \left(\max j v_{ij} \middle| j \in I''\right) \right\} \quad (8)$$

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:

$$D_j^* = \sqrt{\sum_{i=1}^{n} (v_{ij} - v_i^*)^2},\ j = 1, 2, \ldots, J. \quad (9)$$

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

$$D_j^- = \sqrt{\sum_{i=1}^{n} (v_{ij} - v_i^-)^2},\ j = 1, 2, \ldots, J. \tag{10}$$

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):

$$CC_j^* = \frac{D_j^-}{D_j^* + D_j^-},\ j = 1, 2, \ldots, J. \tag{11}$$

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

4. Results

4.1. Case Study

The reliability of the proposed framework was tested and applied in the context of the Lithuanian furniture industry. Lithuania is dominated by traditional industries, which focuses on materials processing [123]. First, the nature of the Lithuanian manufacturing sector, the ongoing increase in participation in global value chains and the products sold show the flexibility of the manufacturing sector, as well as investments in eco-innovations, such as technological and/or product design solutions and/or marketing [124]. However, over time, the Lithuanian manufacturing industry has shifted more toward production with the use of intermediate goods imported from foreign countries and the export of final goods, rather than supplying intermediate goods to foreign markets for further processing and production. Second, in 2018 the Lithuanian furniture industry accounted for approximately 2.5% of the GDP of Lithuania. At the beginning of 2020, the industry employed around 3.0% of the total employment [125]. According to Statista, Lithuanian furniture revenue is expected to grow annually by 4.84% and the industry's largest segment is the Bedroom Furniture segment with a market volume of US$154.20 m in 2023. A total of 971 companies were active in the industry at the beginning of 2020, 97.5% of them were small and medium-sized enterprises with 1–249 persons employed.

4.2. AHP Results

This study provides a strategic management framework that takes into account micro-, meso-, and macro-level environmental factors that help the decision-makers to evaluate eco-innovation strategies. To answer RQ1, an extensive literature analysis was conducted followed by several rounds of discussions with field experts from the Lithuanian furniture industry. To answer RQ2, an AHP method was applied by asking experts which criterion or sub-criterion is more important with respect to the strategic green transformation and the implementation of the eco-innovation strategy. Based on the methodology presented in Section 3, in this study, we classify the criteria and sub-criteria into the following: (1) micro-level environment (resources and capabilities), (2) meso-level environment (market dynamics) and (3) macro-level environment (environmental regulation and taxes and public financial support) with total of 4 criteria and 18 sub-criteria. Table 6 presents local and global weights of criteria and sub-criteria in the eco-innovation strategy selection process. Only the aggregated results of the AHP application that are described in Section 3.1 are presented in this Section.

Table 6. Local and global weights of criteria and sub-criteria in the eco-innovation strategy selection process.

Criteria	Criteria Weight	Criteria Ranking	CR	Sub-Criteria	Sub-Criteria Weight	Sub-Criteria Local Ranking	Sub-Criteria Global Weight	Sub-Criteria Global Ranking
Resources and Capabilities (A)	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 (B)	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 Regulation (C)	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 (D)	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 AHP result reflects the perspective and weights of different criteria and sub-criteria that affect the strategic decision in the process of selecting the eco-innovation strategy. The AHP results highlight that in the process of selection of eco-innovation strategy and strategic green transformation in the Lithuanian furniture industry, the meso-level environment criteria (i.e., market dynamics (B)) are expected to be the most important (0.4888). This is followed by the micro-level environment criteria (i.e., resources and capabilities (A)) with a criteria weight of 0.3256 and finally the macro-level environment with the criteria weight of taxes and regulation (C) 0.0661 and public financial support (D) 0.1195). In this study, the measurement of consistency (CR) was used to evaluate the consistency of decision-makers and the consistency of the overall hierarchy. The acceptable range of the CR value is ≤0.1. Therefore, the CR values (Table 6) lead us to conclude that the evaluations are sufficiently consistent. Figure 3 presents the priority weights of sub-criteria in the selection of the eco-innovation strategy.

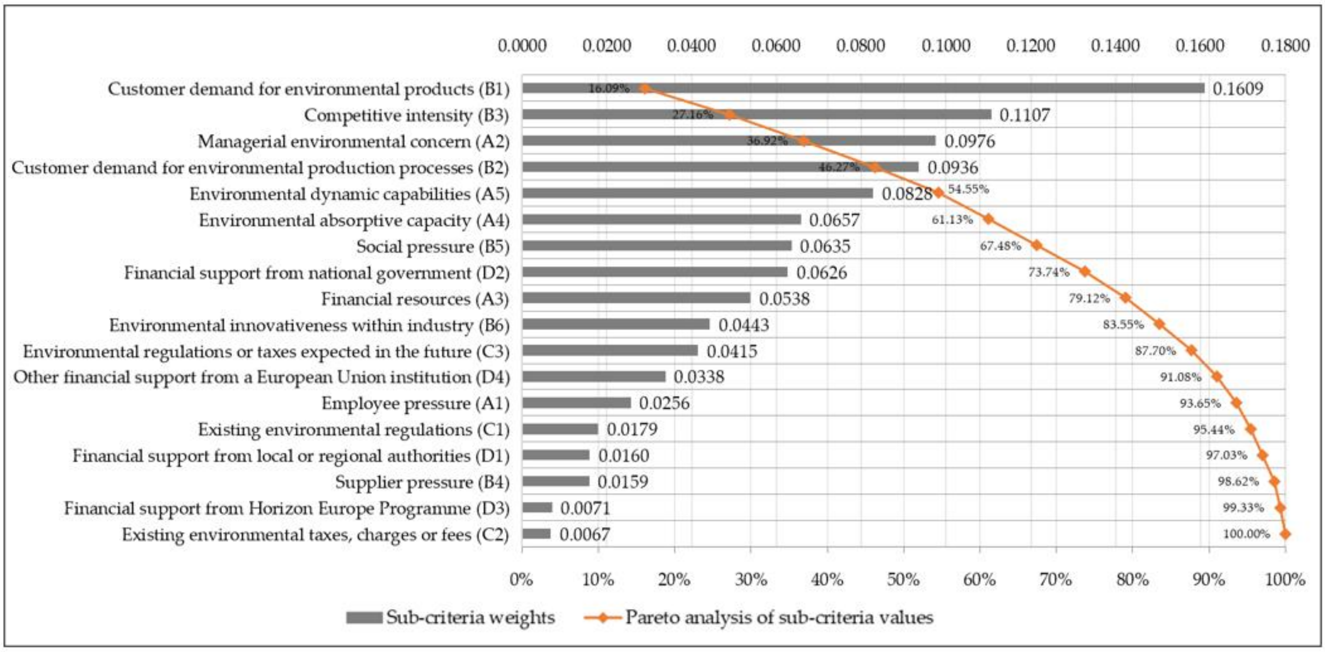


Figure 3. Priority weights of sub-criteria ranking in the descending order and a graphical view of Pareto analysis in the selection of eco-innovation strategy.

Figure 3 shows global weights of sub-criteria and the global ranking in the descending order and a graphical view of Pareto analysis (marked in orange line). Pareto analysis results are based on sub-criteria global weight by calculating the cumulative percentage. Figure 3 demonstrates that in the process of selection of eco-innovation strategy and strategic green transformation, the most important sub-criterion is customer demand for environmental products (0.1609). From Pareto analysis, it is observed that out of 18, 9 sub-criteria are the most significant in the strategic decision-making process and takes almost 80% (79.12%). These are: customer demand for environmental products (0.1609) competitive intensity (0.1107), managerial environmental concern (0.0976), customer demand for environmental production processes (0.0936), environmental dynamic capabilities (0.0828), environmental absorptive capacity (0.0657), social pressure (0.0635), financial support from the national government (0.0626), and financial resources (0.0538). Figure 4 presents the radar graph of priority weights of the most significant sub-criteria in the selection of the eco-innovation strategy.

From the visual representation of the most significant sub-criteria (Figure 4) we can observe that customer demand for environmental products appears to be the most significant sub-criterion in the process of eco-innovation strategy selection and strategic green transformation as compared to other sub-criteria.

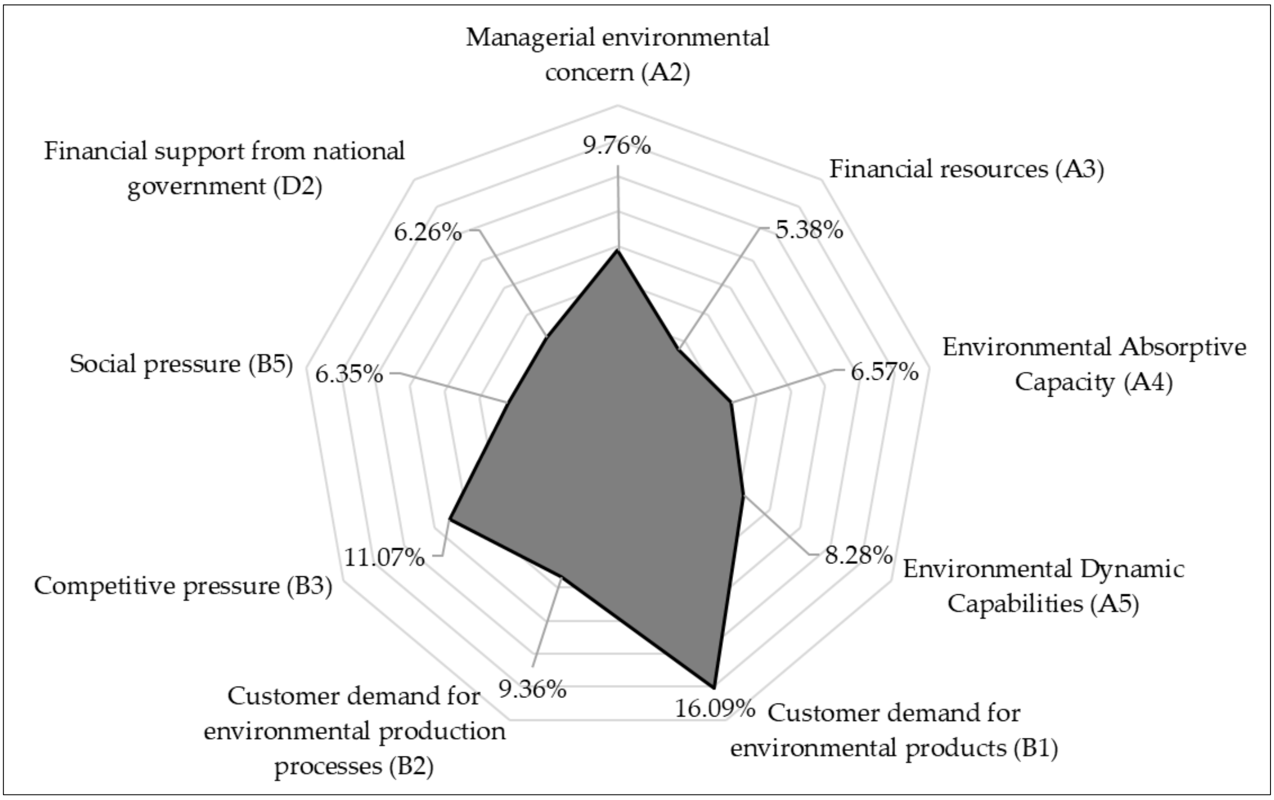
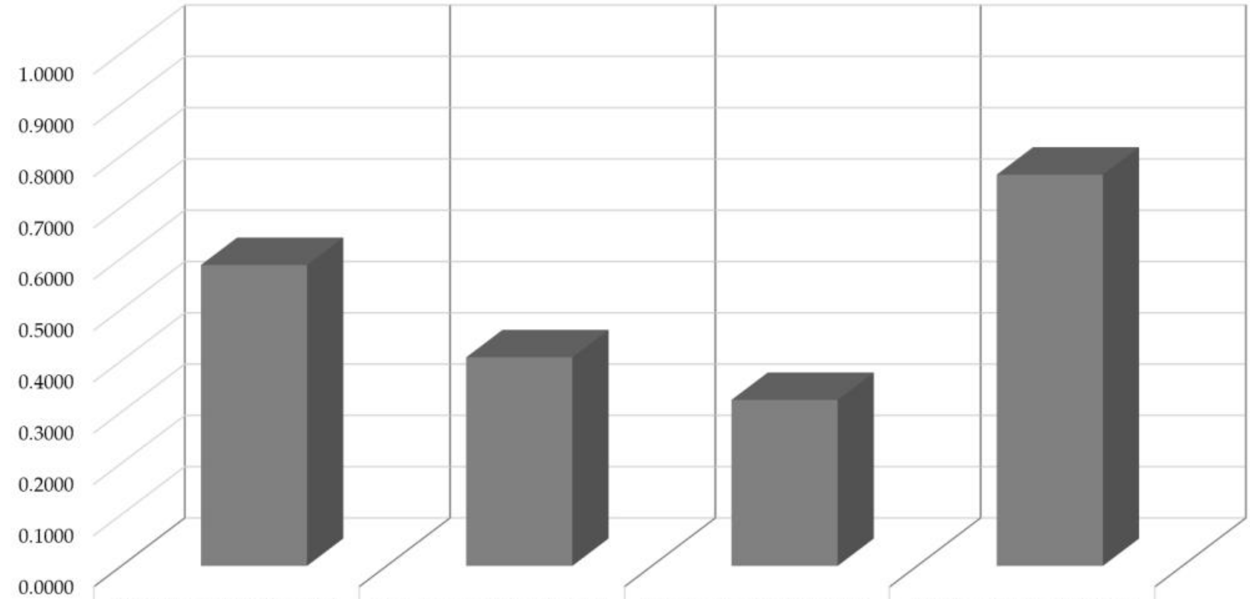


Figure 4. Radar graph of priority weights of the most important sub-criteria in the selection of eco-innovation strategy.

4.3. TOPSIS Results

This Section provides the ranking on eco-innovation strategy, aiming for a competitive advantage in the Lithuanian furniture industry. To answer RQ3, the weights obtained from the AHP analysis were incorporated into TOPSIS to rank the best eco-innovation strategy. To select the best eco-innovation strategy, experts were asked to rate the performance of each strategic alternative with respect to the individual sub-criterion. Only the aggregated results of the TOPSIS application that are described in Section 3.2 are presented in this Section. Figure 5 presents the TOPSIS results and the final prioritizing order of the eco-innovation strategies in the Lithuanian furniture industry.

Figure 5 shows the relative closeness score to the ideal solution and the ranking order. The higher the score and the closer to the value equal to 1, the closer the strategic alternative is to the ideal solution. The ranking of eco-innovation strategies in the Lithuanian furniture industry is as follows. The first and best strategy with the highest score strategy is eco-innovation product differentiation strategy (score: 0.7629). This is followed by eco-innovation process cost leadership strategy (2nd in the rank), eco-innovation product cost leadership strategy (3rd in the rank), and finally, eco-innovation process differentiation strategy (4th in the rank). Section 5 provides a discussion of the results from the perspective of previous studies on micro-, meso-, and macro-level environment criteria and sub-criteria and different eco-innovation strategy alternatives.



	Eco-innovation Process Cost Leadership	Eco-innovation Product Cost Leadership	Eco-innovation Process Differentiation	Eco-innovation Product Differentiation
Closest value	0.2276	0.3391	0.3516	0.1239
Farthest value	0.3233	0.2325	0.1683	0.3986
Score	0.5868	0.4068	0.3237	0.7629
Final Rank	2	3	4	1

Figure 5. The final prioritizing order of eco-innovation strategies.

5. Discussion

5.1. Discussion on Micro-, Meso-, and Macro-Level Environment Criteria

5.1.1. Micro-Level Environment Criteria and Sub-Criteria

Arguably, the environmental policies are generally oriented on the meso- or macro-scale, but the implementation of eco-innovation is carried out at the micro-level of the company [126,127]. Therefore, the long-term and integrative approach of eco-innovation set with the overall firm strategy is essential for a sustainable competitive advantage [127].

The most important sub-criterion in the micro-level environment (3rd in the global ranking) is the managerial environmental concern with the weight of 0.2997 (0.0976 global weight), suggesting that for the Lithuanian furniture industry, top-level managers are the driving force behind the changes in an organization and, presumably, without the belief that environmental issues should be the top priority, the strategic green transformation would be impossible. This result is in line with previous studies [103]. Leonidou et al. 2015 [57] argue that the critical role of managerial sensitivity is crucial when implementing such strategic changes. Eiadat et al. 2008 [32] state that managerial environmental concern is the strongest determinant of eco-innovation strategy, because managers who are environmentally concerned are keener to adopt eco-innovations [65].

The second most important sub-criterion in the micro-level environment (5th in the global ranking) is the environmental dynamic capabilities with the weight of 0.2544 (0.0828 global weight). The results show that this sub-criterion takes more than 25% of the total weight of micro-level environment and is considered to be crucial for the successful implementation of the eco-innovation strategy in the Lithuanian furniture industry. Such importance is in line with previous studies in which Yousaf, 2021 [72] found that environmental dynamic capabilities are a major antecedent of eco-innovation. Lin and Chen, 2017 [73] found that environmental dynamic capabilities positively influence eco-innovation and competitive advantage. The superior the environmental dynamic capabilities, the more success the firm will have in the strategic green transformation through the implementation of a set of eco-innovation. Environmental dynamic capabilities become relevant once the organization has acquired new environmental knowledge and needs to reconfigure existing resources and capabilities to accommodate new practices and technologies. To acquire new environmental knowledge, the environmental absorptive capacity of the organization comes into play.

The third most important sub-criterion in the micro-level environment (6th in the global ranking) is the environmental absorptive capacity with the weight of 0.2018 (0.0657 global weight). For the Lithuanian furniture industry, in order to successfully implement eco-innovation strategy, it is important to be able to obtain, understand, integrate, alter, and exploit environmental knowledge. In the process of eco-innovation strategy, it is essential to evaluate the firm's environmental absorptive capacity, since strategic green transformation is complex and requires more environmental knowledge than traditional innovation [9]. Thus, to implement eco-innovation strategy, companies must be able to constantly learn new environmental knowledge. The importance of environmental absorptive capacity was discussed in previous studies, in which Albort-Morant et al. 2018 [71] and Chen et al. 2015 [69] found that environmental absorptive capacity significantly affects eco-innovation performance, environmental dynamic capabilities, and firm performance. The firms with greater environmental absorptive capacity are able to better understand and internalize new environmental knowledge, technologies, and practices, and effectively combine it with their existing knowledge. Compared to environmental dynamic capabilities, the environmental absorptive capacity appears to be less important in the strategic green transformation. An argument could be made that since eco-innovation strategy is based on adopting existing eco-innovations and not R&D activity, it is more important to be able to reconfigure and utilize firms' existing resources for strategic green transformation.

The fourth most important sub-criterion in the micro-level environment (9th in the global ranking) is financial resources with the weight of 0.1653 (0.0538 global weight), suggesting that for the Lithuanian furniture industry, the financial resources are important to some extent. Undoubtedly, the financial resources that are required for strategic green transformation are essential and similar to the work Khurana et al. 2021 [103], the importance of this sub-criterion shows that the overall financial health of the firm must be considered in eco-innovation strategy. A firm with limited financial resources may not allocate funds to secondary aspects of the firm's main activities [68]. However, as compared to the support of top management and capabilities of the firm, financial resources are less important for strategic green transformation of the firm, suggesting that prior factors are more essential for the implementation of successful eco-innovation strategy.

The least important sub-criterion in the micro-level environment (13th in the global ranking) is the employee pressure with the weight of 0.0787 (0.0256 global weight). Such a low global and local ranking suggests that in the Lithuanian furniture industry, employee pressure and attitudes towards environmental issues are considered as a low importance factor. The results do not confirm previous research by Weng et al. 2015 [63], which states that employees are often the initiators and pressure the organization to adopt environmental protection practices. An argument could be made that traditionally and culturally, Lithuanian employees have less pressure to negotiate and pressure the organization to implement changes, especially in the traditional manufacturing sector, where the personnel structure consists of mostly low-skilled workers. However, this result supports previous sub-factor ratings that top-level management are the driving force behind strategic changes.

5.1.2. Meso-Level Environment Criteria and Sub-Criteria

Market dynamics is referred to the traditional "market-pull" factor [94,128], and in the contemporary business environment, eco-innovation strategy has become critical for a competitive advantage of companies and a tool to cope with strong competition [65].

The most important sub-criterion in the meso-level environment (1st in the global ranking) is the customer demand for environmental products with the weight of 0.3292 (0.1609 global weight), suggesting that for the Lithuanian furniture industry, the customer demand for environmental products is a significant factor when it comes to the strategic decision to implement eco-innovation strategy. Such importance of green consumerism of customers has previously been supported by Li, 2014 [74]. When it comes to green products, customer demand is the most important factor to consider [76]. Arguably, without customer demand for environmental products, companies could potentially waste their resources by transforming traditional products into green products without gaining any competitive advantage. However, environmental awareness and the growing consumer demand for eco-friendly products are increasing [14]. Thus, the pioneering company which takes the lead in implementing eco-innovation strategy to transform green products can enjoy the "first-mover advantage" [129]. Consequently, in the strategic decision process, it is crucial to perform market research and evaluate the customer demand for environmental products.

The second most important sub-criterion in the meso-level environment (2nd in the global ranking) is the competitive intensity with the weight of 0.2264 (0.1107 global weight), suggesting that for the Lithuanian furniture industry, the level of competitive intensity and the competitive pressure for environmental products and processes in the market play a huge role in the strategic decision process to implement eco-innovation strategy. This result is in line with previous studies [57]. Cai and Li, 2018 [78] argue that competitive pressure is the main driver to adopt eco-innovation. Similarly, Hojnik and Ruzzier, 2016 [65] argue that fierce competition works as a driving force of eco-innovation. Hence, it is crucial to consider the level of competitive intensity in the strategic decision process, and based on the competitive pressure for environmental products or processes, the company could implement eco-innovation strategy to gain a sustainable competitive advantage.

The third most important sub-criterion in the meso-level environment (4th in the global ranking) is the customer demand for environmental production processes with the weight of 0.1914 (0.0936 global weight), suggesting that for the Lithuanian furniture industry, customer demand for environmental production processes is a very important factor when it comes to the strategic decision to implement eco-innovation strategy. Compared to the customer's demand for environmental products, the customer's demand for environmental production processes is less important. An argument could be made that such a result is depends on the firm's position in the value chain. End consumers could potentially put more emphasis on the environmental impact of the product, while the partners in the value chain could potentially place more emphasis on the processes of manufacturing the intermediate and final goods. Arguably, the results could differ if firms' participation in global value chains is more so-called "forward participation" which refers to the export of domestically produced goods or services to the third economies for further processing and export through supply chains [130].

The fourth most important sub-criterion in the meso-level environment (7th in the global ranking) is the social pressure with the weight of 0.1300 (0.0635 global weight), suggesting that for the Lithuanian furniture industry, when it comes to the strategic decision to implement eco-innovation strategy, social pressure is only important to some extent. One possible explanation for this relatively low importance is that in this study we have separated stakeholders to better investigate pressure groups. In this study we have investigated social pressure from non-market constituents (such as media, non-governmental organizations, environmentalists), compared to other studies that investigated social pressure from a broader perspective including consumers, government, etc., where social pressure was more important [82,83].

The fifth most important sub-criterion in the meso-level environment (10th in the global ranking) is the environmental innovativeness within industry with the weight of 0.0906 (0.0443 global weight). Referring to the technology-push hypothesis, such result suggests that in the Lithuanian furniture industry only to some extent the decision to implement eco-innovation strategy is affected by technological advances in the industry [84]. One possible explanation for this result is that since eco-innovation strategy is firm-level strategy, the environmental innovativeness within industry does not affect the strategic decision as much as other factors. It is more important that the firm could use full potential of eco-innovations that are developed in the industry, thus environmental absorptive capacity and environmental dynamic capabilities are more significant factors.

The least important sub-criterion in the meso-level environment (16th in the global ranking) is the supplier pressure with the weight of 0.0325 (0.0159 global weight), suggesting that for the Lithuanian furniture industry, when it comes to the strategic decision to implement eco-innovation strategy, supplier pressure is relatively unimportant. Supplier can pressure a company to implement eco-innovation and adapt to changes in supplier's environmental products or processes. However, in the Lithuanian furniture industry, suppliers do not possess such power. This result is in line with previous studies [79]. Weng et al. 2015 [63] found that supplier pressure on eco-innovation practices was not significant.

5.1.3. Macro-Level Environment Criteria and Sub-Criteria

Macro-level environment criteria, that is, public financial support and environmental regulations, are referred to the traditional "regulatory push/pull" factor [94,128], and such command and control instruments and economic incentives are the most studied factors in the existing scientific literature on eco-innovation. However, mixed results on the effect can be found. Arranz et al. 2021 [94] confirmed that subsidies had a positive effect on eco-innovation. Segarra-Blasco and Jové-Llopis, 2019 [92] revealed that both public financial support and government regulation were strongly related and played an essential role in promoting eco-innovations among small and medium-sized enterprises in the EU. In contrast, Capozza et al. 2021 [131] argues that taxes and regulations do not affect the strategic decision to implement eco-innovation.

The most important sub-criterion in the macro-level environment (8th in the global ranking) is the financial support from the national government with the global weight of 0.0626 (0.5240 local weight), followed by environmental regulations or taxes expected in the future (11th in the global ranking) with the global weight of 0.0415 (0.6278 local weight). It appears that for the Lithuanian furniture industry, these two factors are the most important when considering the strategic decision to implement eco-innovation strategy. Other sub-criteria importance is relatively negligible. One possible explanation for this result is that since eco-innovation strategy is a proactive firm strategy rather than reactive, it is important for firms to consider the anticipated legislation compared to existing regulation and taxes. Similarly, financial support from national government programmes could outweigh other financial support sub-criteria because, for instance, in Lithuania, when it comes to other financial support from the EU institutions, the main barriers are related to administrative costs that do not offset the benefits of funding; lack of specialists and information about the benefits of the measures; restrictions and requirements for potential applicants; low maturity of market participants, as well as few service providers who can provide quality consultations and carry out eco-innovation [132]. A similar result was found by Arranz et al. 2019 [93], confirming that the EU funding is not significant and the regional or national funding had a positive effect on the implementation of eco-innovation. Simply put, the explanation resides in the fact that the size of these subsidies and taxes are too small to consider when it comes to strategic green transformation.

5.2. Ranking of Eco-Innovation Strategy Alternatives

One major strategic choice that firms make is to decide whether to compete in price or quality. Firms that focus on competitive quality are more likely to introduce new products to the market, while firms that focus on competitive price put more emphasis on process efficiency and resource savings [133]. Similarly, the integration of eco-innovation practices into the firm's strategy could create a competitive advantage through increased performance through cost reduction and/or improved reputation in the market [134,135]. Sections 5.2.1–5.2.4 provides the discussion on different eco-innovation strategies.

5.2.1. Eco-Innovation Product Differentiation Strategy

In this study, eco-innovation product differentiation strategy (score: 0.7629) is the first in the ranking and is considered to be the best strategy in the Lithuanian furniture industry. The strategy is related to product transformation through eco-product innovation by adding additional environmental dimensions to the product such as recyclable packaging, biodegradable construction, toxic-free materials, etc. According to Przychodzen et al. 2020 [136], in a highly competitive environment, depending on environmental development within the market, it can be difficult to differentiate on environmental dimension because most likely other competitors have already introduced such product eco-innovations. Therefore, the firm's decision to differentiate through eco-innovation is highly dependent on whether the firm seeks the first mover advantage [136]. In the Lithuanian furniture industry, the level of competitive intensity when considering the environmental dimension is very important and plays a huge role in the strategic decision process when considering the implementation of eco-innovation strategy. However, in the Lithuanian furniture industry, the competitive intensity when considering the environmental dimension of the product is quite low. A plausible interpretation is that most of the companies operating in the furniture industry are more reactive than proactive when it comes to eco-innovation. Therefore, the results of our study reveal that eco-innovation product differentiation is the best strategy if a company seeks a sustainable competitive advantage. The importance of eco-innovation product differentiation strategy is in line with previous studies. Leonidou et al. 2015 [57] found that firm product differentiation by adding additional environmental dimensions to the product positively affects both export and financial performance. Similarly, Chen and Liu, 2018 [59] found that the firm's differentiation strategy had a positive effect on the relationship between the product eco-innovation and the performance of the firm.

5.2.2. Eco-Innovation Process Cost Leadership Strategy

In this study, the eco-innovation process cost leadership strategy (score: 0.5868) is the second in the ranking for the Lithuanian furniture industry. The strategy is related to increased operation efficiency and more efficient logistics, operations, marketing and sales, services and supporting activities through eco-process innovation. This result implies that in the furniture industry, as a second strategic alternative to the product differentiation strategy, the firm could consider the process cost leadership strategy. However, the score of 0.58/1.00 is relatively low compared to the best strategy. Nevertheless, the eco-innovation process cost leadership strategy could potentially be a viable option for firms to achieve a competitive advantage, and it has been supported in previous studies. Chen and Liu, 2018 [59] investigated firms in manufacturing sectors in China and found that cost leadership strategy had a negative effect on the relationship between product eco-innovation and performance of the firm, and had a positive effect on the process eco-innovation and performance of the firm. Therefore, Chen and Liu, 2018 [59] argue that product cost leadership strategy conflicts with eco-innovation, which incurs high costs. However, eco-innovation process cost leadership approach reduces resource consumption and increases efficiency, which is in line with the focus on cost-leadership strategy. Furthermore, Leonidou et al. 2015 [57] argue that the benefits associated with cost savings can also arise from the achievement of economies of scale, resulting in an increased acceptance of environmentally friendly products, especially by the green consumer segment.

5.2.3. Eco-Innovation Product Cost Leadership Strategy

In this study, eco-innovation product cost leadership strategy (score: 0.4068) is the third in the ranking in the Lithuanian furniture industry. The strategy is related to minimizing general costs and reducing material and energy resources through eco-product innovation related to product design, packaging, introduction of substitutes, etc. Arguably, the score of 0.40/1.00 is too low to consider for a firm compared to the best strategy in the Lithuanian furniture industry. Cost-related benefits, i.e., cost savings, have been found to be a decisive determinant of eco-innovation adoption [61]. However, eco-innovation cost leadership strategy is not always the best strategy, since to take advantage of eco-innovation product cost leadership strategy, companies are leveraging and highlighting the environmental properties of products in competitive markets, but eco-innovation product cost-leadership strategy is focused on cost reduction related to green product transformation rather than advertising and communicating the novelty of the environmental characteristics of new products. Similarly, Chen and Liu, 2018 [59] highlights that the increased benefits in product eco-innovation efficiency do not cover the expenses that are generated in the implementation of eco-innovation process. Arguably, strategic green transformation of organizational products can be effective in promoting customer loyalty, entering new markets or segments, expanding the product portfolio and acquiring more premium benefits and making a unique product compared to its competitors, with the result of greater economic benefits and a more profitable outcome [59].

5.2.4. Eco-Innovation Process Differentiation Strategy

In this study, eco-innovation process differentiation strategy (score: 0.3237) is the last in the ranking in the Lithuanian furniture industry. The strategy is related to brand image differentiation through eco-process innovation that reduces air, water, noise, or soil pollution, replaces fossil energy with renewable energy sources, achieves environmental certificates, eco-labels, or green awards, and creates a distinct green organization brand image for customers. Arguably, the score of 0.32/1.00 is too low to consider for a firm compared to the best strategy in the Lithuanian furniture industry. One possible explanation for this result is that in the last decade, the Lithuanian furniture industry has shifted more toward production with the use of intermediate goods imported from foreign countries and the export of final goods, rather than supplying intermediate goods to foreign markets for further processing and production. Simply put, the Lithuanian furniture industry is more focused on the end customer and product differentiation is more important compared to process differentiation, since end consumers could potentially put more emphasis on the environmental impact of the product, while the partners in the value chain could potentially place more emphasis on the processes of manufacturing the intermediate and final goods. However, environmental certificates, eco-labels, and green awards such as ISO14001 help firms differentiate in their markets [35] and foreign markets [57], increase firm competitiveness and brand awareness, and acquire customer recognition, which can be beneficial depending on the firm's position on the market.

6. Conclusions and Agenda for Future Research

6.1. Conclusions

In summary, the evaluation and selection of eco-innovation strategies is a significant and complex strategic decision, and despite the relevance and interest in the field of eco-innovation, the area of eco-innovation strategies has not been explored in depth in the scientific literature and the general nature of eco-innovation strategies remains complex and unclear. We argue that contemporary strategic management of eco-innovation has changed from the selection of the best eco-innovation practices, characterized by rankings and competitiveness, to the selection of a set of eco-innovation solutions that best meets the firm's strategic goals. Therefore, in this study, we propose an integrated approach to the evaluation of eco-innovation strategies and strategic green transformation that help decision-makers evaluate and select the eco-innovation strategy for a competitive advantage. The reliability of the proposed framework was tested and applied to the Lithuanian furniture industry. To the best of our knowledge, this is the first study that considered the eco-innovation strategy from the perspective of strategic green transformation of the firm to achieve a competitive advantage. This is essential due to the fact that contemporary typologies of eco-innovation do not always include holistic approaches of the firm [51].

6.1.1. Theoretical Implications

This study makes a significant contribution to the literature on 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. First, this study conceptualizes eco-innovation strategy from the perspective of strategic green transformation and proposes a novel definition and classification of eco-innovation strategies. By conceptualizing eco-innovation strategy from the perspective of strategic green transformation aiming to achieve a competitive advantage in four mutually exclusive and collectively exhaustive strategies, we open the venue to further investigation of each of the strategies with respect to the strategic transformation area. Moreover, such conceptualization could be considered as a foundation when it comes to the inclusion of both economic and environmental dimensions.

Second, this study provides insights on the factors that affect the strategic decision to implement eco-innovation strategy and sets an agenda for future research. The field of eco-innovation is very crowded with studies that investigate the drivers of eco-innovation. However, the factors that affect the implementation of eco-innovation strategy have been neglected. Arguably, in the implementation of eco-innovation strategy, different factors are at play; therefore, it is important to separate the driving factors that push/pull towards eco-innovation strategy from the factors that are necessary to evaluate in the eco-innovation strategy implementation process.

6.1.2. Practical Implications

The results of this study contain practical implications, as this study proposes a novel approach to the evaluation of eco-innovation strategies and the strategic green transformation of the manufacturing firm taking into account micro-, meso-, and macro-level environmental factors. First, such eco-innovation strategy alternative formulation and classification of the criteria set helps the decision-makers to evaluate and select eco-innovation strategy. Additionally, criteria or sub-criteria that are outside of the proposed criteria set scope and are specific to a certain industry or company can be easily added to the criteria pool and evaluated based on the proposed methodology. Second, the proposed novel approach and the classification of the four mutually exclusive and collectively exhaustive eco-innovation strategies not only provides a framework for making strategic decisions but, more importantly, a framework for discussing the strategic decisions within the company.

6.1.3. Limitations

Although this study contributes significantly and this study adopted a validated multi-criteria decision-making methodology from previous studies and followed strict guidelines presented in the research methodology (Section 3), it has some limitations. For instance, the reliability of the proposed framework was tested and applied in the context of the Lithuanian furniture industry; therefore, it is not possible to achieve a generalized consensus of the best eco-innovation strategy for manufacturing sector through this case study. However, the validated MCDM methodology adopted from previous studies is novel for the selection of eco-innovation strategies and the strategic green transformation in the Lithuanian furniture industry case and within the available literature in the domain. Another potential limitation is tied due to the applied methodology. A combined AHP-TOPSIS have been extensively utilized in various strategy selection studies, however, the AHP-TOPSIS does not take into consideration the interdependence between criteria and sub-criteria; therefore, future studies could address this limitation by applying other MCDM such as analytic network process (ANP). Another possible drawback of this study is that it deals with taking the opinion of experts, which can be biased, as the opinion is based on the expert's understanding of the subject and human judgement. However, the expert selection criteria that are stated in Section 3 minimize bias and random errors.

6.2. Agenda for Future Research

Finally, this study shows the importance of distinguishing environmental factors that affect the strategic decision in the evaluation and selection process of eco-innovation strategy into three levels. Regarding the aim of this study: to analyze the criteria and sub-criteria of the eco-innovation strategy to develop an integrated approach to evaluate and select eco-innovation strategies in the manufacturing sector, and the results of this study, in this study we propose an agenda for future research in the field of eco-innovation strategies and strategic green transformation. Hence, this study can serve as the basis for future work in the direction of eco-innovation strategies and strategic green transformation to achieve a competitive advantage.

First, the micro-level: agenda for future research. This study highlights the importance of the environmental dynamic capabilities and the environmental absorptive capacity of the firm in the strategic decision-making process for the selection of eco-innovation strategy. Therefore, future research should consider investigating both environmental absorptive capacity and environmental dynamic capabilities as separate criteria and not sub-criteria in the strategic decision-making process for selecting eco-innovation strategy to obtain a better understanding of these important factors.

Second, the meso-level: agenda for future research. This study highlights the importance of competitive intensity when considering the environmental dimension in the strategic decision-making process for the selection of eco-innovation strategy. Therefore, future research should consider investigating the level of competitive intensity as a separate criteria and not sub-criteria in the strategic decision-making process for selecting eco-innovation strategy to obtain a better understanding of this important factor. The classic strategic management framework which investigates separate competitive intensity items could be a referencing point. Additionally, this study shows the importance of the customer demand for both environmental products and processes in the strategic decision-making process for the selection of eco-innovation strategy. Therefore, the future research should consider investigating different firms depending on their position in the value chain.

Third, the macro-level: agenda for future research. This study highlights the importance of the financial support from the national government in the strategic decision-making process for the selection of eco-innovation strategy. Therefore, future research should consider investigating how financial support from the national government affects different sectors, as funding particularly targets the most polluting sectors. Given these points, further knowledge on the topic is needed, and further analysis would reveal the critical aspects of eco-innovation strategy and would open the avenues for sustainable growth creating opportunities for social, economic, and environmental advantages consistent with the global efforts to combat climate change.

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Appendix A

Table A1. Demographics data of the experts.

Expert Label	Education Level	Age	Position	Years of Experience	Represented Company Size
E1	Graduate	53	Production Manager	25	Medium-sized enterprise (50–249)
E2	MBA	39	General Manager	13	Medium-sized enterprise (50–249)
E3	Graduate	52	Production Manager	22	Medium-sized enterprise (50–249)
E4	Ph.D.	51	Marketing Manager	17	Medium-sized enterprise (50–249)
E5	Graduate	49	Production Manager	18	Medium-sized enterprise (50–249)
E6	Graduate	40	Director of operations	11	Medium-sized enterprise (50–249)
E7	MBA	53	General Manager	19	Medium-sized enterprise (50–249)
E8	Graduate	47	Director of operations	22	Medium-sized enterprise (50–249)

Note: The names of the respondents are not disclosed on due to privacy and legal rights.

Appendix B

Table A2. The description of each sub-criteria.

Sub-Criteria (Label)	Description
Employee pressure (A1)	Refers to the pressure and attitudes of employees towards 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.
Environmental absorptive capacity (A4)	Refers to the company’s ability to obtain, understand, integrate, alter, and exploit environmental knowledge.
Environmental dynamic capabilities (A5)	Refers to the company’s ability to utilize its existing resources and knowledge for transformation related to environmental protection.
Customer demand for environmental products (B1)	Refers to customer demand for eco-friendly products and to meet the requirements of environmental regulations, as well as when customer pay great attention to the green concept contained in products.
Customer demand for environmental production processes (B2)	Refers to customer demand for overall company’s environmental responsibility and eco-friendly production processes.
Competitive intensity (B3)	Refers to the competitive intensity level and competitive pressure for environmental products and processes in the market, as well as “how green are the competitors”.
Supplier pressure (B4)	Refers to supplier pressure for eco-innovation through pressure to adapt to changes in supplier’s environmental products or processes.
Social pressure (B5)	Refers to other stakeholders, non-governmental organizations, social demands, environmentalists, and demand for overall company’s environmental responsibility.
Environmental innovativeness within industry (B6)	Refers to the level of environmental innovativeness within industry and how other companies within the industry are technologically and environmentally advanced.

Table A2. *Cont.*

Sub-Criteria (Label)	Description
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.
Environmental regulations or taxes expected in the future (C3)	Refers to environmental regulations or taxes that are expected to occur in the future.
Financial support from local or regional authorities (D1)	Refers to financial support for innovation activities that help reduce negative environmental impact of local or regional authorities.
Financial support from national government (D2)	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 (D3)	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 (D4)	Refers to other financial support from a European Union institution for innovation activities that help to reduce the negative environmental impact.

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