



**Contemporary Insights on Financial
and Economic Performance of Companies**

Edited by

Piotr Łasak

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Journal of Entrepreneurship, Management and Innovation (JEMI) ([e] ISSN 2299-7326, [p] ISSN 2299-7075) is an interdisciplinary, double-blind peer-reviewed journal, emphasizing theoretical and empirical articles on entrepreneurship, management, and innovation. The journal is published in ELECTRONIC (online first) and PRINT (occasionally) formats. See our website: <http://www.jemi.edu.pl>.

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Responsive and proactive market orientation and hospital financial performance: The mediating effect of service program innovativeness

Dariusz Dąbrowski¹ , Wioletta Kukier² , Anna Tybińkowska³ 

Abstract

PURPOSE: The study aims to investigate the direct and indirect relationships among market orientation, service program innovativeness, and the financial performance of hospitals. Two types of market orientation – responsive and proactive – were considered, along with two dimensions of service program innovativeness: meaningfulness and novelty. **METHODOLOGY:** The study gathered data through a survey conducted on a random sample of 204 Polish hospitals. Structural equation modeling was used to analyze the data, test a conceptual model designed as a parallel two-mediator model, and validate the hypotheses. **FINDINGS:** The work revealed both direct and indirect effects. In terms of direct effects, the study found that implementing a responsive market orientation positively influences the meaningfulness of a hospital's service program but has no impact on its novelty. Conversely, the implementation of a proactive market orientation has a positive influence on both the meaningfulness and novelty of the program. Furthermore, the meaningfulness and novelty of the program contribute positively to the hospital's financial performance. In terms of indirect effects, the study identified mediation phenomena: a responsive market orientation positively affects a hospital's financial performance through the meaningfulness of the service program, while a proactive market orientation enhances financial performance through the novelty of the program. **IMPLICATIONS:** The study contributes to the current understanding, confirming the positive impact of a proactive market orientation on innovations within the organization while contradicting the view that a responsive market orientation supports these innovations. Additionally, the results support the idea that innovations within the organization have a positive impact on its outcomes. The study also reveals specific mechanisms that influence market orientation on organizational outcomes, indicating that a responsive orientation affects a service provider's outcomes through the meaningfulness of its service program, while a proactive orientation influences outcomes through the novelty of the program. The practical recommendations for hospital managers are as follows: (a) to achieve a high level of meaningfulness in the service program, it is advisable to implement both responsive and proactive market orientations; (b) to attain a high level of novelty in the program, a proactive market orientation is recommended; (c) to enhance the hospital's financial performance, it is suggested to develop a service program that is both meaningful and novel, and to implement both responsive and proactive market orientations. **ORIGINALITY AND VALUE:** The study's originality and value stem from its exploration of specific direct and indirect mechanisms through which market orientation affects hospital financial performance, filling a prior research gap. By investigating these mechanisms, the study enhances the overall understanding of hospital management.

Keywords: market orientation, responsive orientation, proactive orientation, healthcare, financial performance, innovativeness.

1 Dariusz Dąbrowski, Ph.D. Hab. Eng., Professor of Gdańsk University of Technology, Faculty of Management and Economics, G. Narutowicza 11/12, 80-233 Gdańsk, Poland, e-mail: dariusz.dabrowski@zie.pg.gda.pl (ORCID: <https://orcid.org/0000-0002-2045-2683>).

2 Wioletta Kukier, Ph.D. Student, Gdańsk University of Technology, Faculty of Management and Economics, G. Narutowicza 11/12, 80-233 Gdańsk, Poland, e-mail: wioletta.kukier@gmail.com (ORCID: <https://orcid.org/0009-0002-3504-6730>).

3 Anna Tybińkowska, M.A. MBA, Hospital Director, Nu-Med Grupa SA Radiotherapy and Oncology Center, Królewiecka 146, Elbląg 82-300, Poland, e-mail: annatybinkowska@gmail.com (ORCID: <https://orcid.org/0009-0000-7201-264X>).

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INTRODUCTION

In developed countries with well-established and advanced healthcare systems, patients have access to medical services provided by various public and private healthcare organizations. As a result, patients have the opportunity to choose a healthcare institution that can offer them specific medical services. This creates competition among healthcare providers, who strive to create their service programs according to the needs and preferences of potential patients. From the perspective of patients, healthcare services play a vital role as they significantly impact their quality of life. Berry and Bendapudi (2007) argue that healthcare services are arguably the most personal and important services consumers purchase. In this context, the market orientation of healthcare organizations can be seen as an essential and necessary approach in the healthcare sector (Mu et al., 2019).

Market orientation means that an organization recognizes the needs of customers, both expressed and latent, and strives to satisfy them as far as possible while still being profitable (e.g., Ellis, 2006; Kirca et al., 2005; Narver & Slater, 1990; Qu, 2014). As this approach is natural and in line with the concept of the market economy, it has therefore already been noticed that market orientation supports the achievement of high organizational performance (Lee et al., 2015; Narver & Slater, 1990; Osorio Tinoco et al., 2020; Wilson et al., 2014). However, according to Narver and Slater (1990), market orientation creates the right behaviors and conditions for the development of superior products or services, which, in turn, allow for the achievement of excellent results. Therefore, it can be assumed that market orientation indirectly affects an organization's performance through certain mediators (Kirca et al., 2005), such as superior products or services. This paper addresses a research problem that involves providing an answer to the following research question (RQ):

RQ) How do responsive and proactive market orientations impact the results of an organization through two aspects of the innovativeness of the service program, namely its meaningfulness and novelty?

This question warrants additional research attention. Studies have shown that the market orientation of an organization supports innovation (Cantaleano et al., 2018; Lakshman et al., 2017; Milfelner et al., 2019; Sandvik & Sandvik, 2003; Wang & Liu, 2020), which, in turn, translates into improved results (Han et al., 1998; Na et al., 2019; Wang & Liu, 2020; Zhang & Duan, 2010; Zhou et al., 2005). However, market orientation can take a responsive or proactive form (Narver et al., 2004), while the innovativeness of products or services is characterized by two dimensions, namely their meaningfulness and novelty (Chen & Arnold, 2022; Duan et al., 2020; Heirati & Siahtiri, 2019; Stock & Zacharias, 2013). Therefore, for an organization aiming to achieve high performance, it is crucial to understand how different types of market orientation influence both dimensions of the innovativeness of the product or service program and how these aspects translate into the results of an organization.

A review of the current literature indicates that studies have been conducted regarding the mediating role of innovation in the relationship between market orientation and organizational results (Bamfo & Kraa, 2019; Han et al., 1998; Kocak et al., 2017; Migdadi et al., 2017). However, to the best of the authors' knowledge, there still exists a gap in the current knowledge involving the understanding of how responsive and proactive market orientations influence the two dimensions of product or service program innovativeness and how these dimensions affect the organization's results. This kind of knowledge will enable organizations to choose a specific type of market orientation and shape a certain aspect of the innovativeness of the offered program, which, in turn, will allow the results of the organization to be influenced.

The existence of the mentioned research gap is confirmed by the results of the review of peer-reviewed articles using a conjunction of the following phrases: (i) "market orientation" or "responsive market orientation" or "proactive market orientation," (ii) "service innovation" or "service innovativeness," and (iii) "organizational outcomes," in abstracts, titles, and keywords. Based on this review, we identified a total of 13 articles related to the topic of market orientation, service innovation, and organizational outcomes. However, none of these publications addressed the specific issue that is the subject of our study.

Building on the theoretical background of market orientation, the aim of the study is to enhance the understanding of the direct and indirect relationships between market orientation, service program innovativeness, and the financial performance of hospitals. This objective was achieved by assuming the existence of two types of market orientation: responsive and proactive, as well as defining the innovativeness of the service program using two dimensions: meaningfulness and novelty. We posit that a hospital's market orientation, both responsive and proactive, influences the novelty and meaningfulness of its service program, which, in turn, impacts the hospital's financial performance.

The existence of such effects is supported by a market orientation perspective that enables the provision of innovative services to achieve favorable outcomes (Srivastava et al., 2001).

This study focuses on the service program, also referred to as the service portfolio, which encompasses the entire range of services offered by a hospital (Stock & Zacharias, 2013) (Stock, 2011). Consequently, the study adopts a service program-level approach that is suitable for analyzing the relationships between the market orientation of a hospital, both responsive and proactive, and its overall financial performance. This is because these factors refer to the entire organization, similar to service program innovativeness. Furthermore, healthcare services are complex and patients require a “whole person” service (Berry & Bendapudi, 2007). Therefore, the innovativeness of the service program of a healthcare institution is important for potential patients.

Our study constitutes a contribution to the current knowledge in several ways. Firstly, our results confirm the relatively common belief in the positive impact of a proactive market orientation on innovations within the organization, as they indicate the favorable influence of this orientation on the meaningfulness and novelty of the service program. However, they contradict the perspective assuming that a responsive market orientation supports these innovations because this type of orientation positively affects only the meaningfulness of the service program, not its novelty. Secondly, our results align with the approach that innovations within the organization positively influence its outcomes. Thirdly, our findings reveal the existence of specific mechanisms, hitherto undiscovered, related to the influence of a specific type of market orientation on organizational outcomes. The first of these mechanisms indicates that a responsive market orientation affects the outcomes of a service provider through the meaningfulness of its service program, while the second shows that a proactive market orientation influences these outcomes through the novelty of this program.

The healthcare system in Poland is a network of individuals and institutions tasked with providing healthcare to the population. According to the Polish constitution, every citizen has the right to health protection, and public authorities are responsible for ensuring access to healthcare services. The Polish healthcare system is based on an insurance model, with the main source of funding being health insurance in the National Health Fund (NFZ). Citizens contribute a mandatory insurance premium to the NFZ, amounting to 9% of their personal income (Sowada et al., 2019).

In the Polish medical services market, there is both public healthcare, mainly funded by the NFZ, and private healthcare, financed by the NFZ, as well as other sources (e.g., direct patient payment or private health insurance). Among all medical entities, public facilities dominate; for instance, in 2018, Poland had 949 hospitals (Polish Statistical Office, 2024), of which about 70% were public, including local government hospitals, and 30% were non-public (*Private hospitals in Poland*, 2023). The majority of medical services in Poland are funded by the NFZ, both in public and private institutions. Medical facilities, based on signed agreements with the NFZ, settle the provided medical services with the NFZ and receive financing from this fund (Sowada et al., 2019).

CONCEPTUAL BACKGROUND

Market orientation and its responsive and proactive forms

Market orientation is based on the implementation of a marketing concept, which assumes that identifying and satisfying the needs of target customers to a greater extent than competitors is crucial for achieving the goals of the organization (Iyer et al., 2018; Kirca et al., 2005; Narver et al., 2004; Ye et al., 2023). The concept of market orientation has been a topic of intense interest among researchers for over three decades, dating back to the classical works of Kohli and Jaworski (1990) and Narver and Slater (1990), which addressed the understanding of market orientation. Narver and Slater (1990) propose a broader understanding of market orientation than Kohli and Jaworski (1990), but both approaches complement each other. Narver and Slater (1990) define market orientation as the organizational culture that most effectively generates the necessary behaviors for creating higher value for buyers than competitors, resulting in superior performance. On the other hand, Kohli and Jaworski (1990) highlight key behaviors characterizing market orientation and define it as the organization's generation of market intelligence regarding current and future customer needs, the dissemination of this intelligence across departments, and organization-wide responsiveness to these needs. Narver and Slater (1990) point out three main components of market orientation: customer orientation, competitor orientation and inter-functional coordination, while Kohli and Jaworski (1990) distinguish three dimensions of this orientation in the form of knowledge generation, its dissemination and response.

Most research findings indicate that market orientation contributes to achieving the high performance of an organization (e.g., Lee et al., 2015; Narver & Slater, 1990; Osorio Tinoco et al., 2020; Wilson et al., 2014); however, in some cases, a positive impact of market orientation on this performance has not been observed (Greenley, 1995; Qu, 2014; Suliyanto, 2012). One possible reason for these mixed results may be the presence of market orientation in two distinct forms: responsive and proactive. The lack of differentiation between these forms in research may lead to different results. Accordingly, Narver et al. (2004) suggest that researchers questioning the influence of market orientation on innovation did not consider proactive market orientation.

The two mentioned forms of market orientation began to be distinguished roughly two decades ago (Narver et al., 2004) based on the difference between expressed and latent needs. Expressed needs are those of which customers are aware and can articulate, while latent needs are those that customers are unaware of and cannot articulate (Narver et al., 2004; Osorio Tinoco et al., 2020).

A responsive market orientation is focused on meeting expressed needs. An organization applies a responsive market orientation when it emphasizes the recognition and fulfillment of the needs that customers are aware of. On the other hand, a proactive market orientation is concerned with addressing latent needs. In this case, the organization aims to discover the needs that customers are unaware of and then respond to them (Narver et al., 2004; Osorio Tinoco et al., 2020).

Hospitals can adopt both forms of market orientation. For instance, a hospital implementing a responsive market orientation may establish a comprehensive pain management program to address the articulated need for adequate pain management and symptom relief. On the other hand, an example of implementing a proactive market orientation is the detection of health issues and patients' needs of which they are not aware, based on preventive examinations, followed by preventing the development of or treating the identified conditions.

Service program innovativeness

According to Amabile and Pratt, innovation is defined as “the successful implementation of creative ideas within an organization” (Amabile & Pratt, 2016, p. 158). This definition is based on Schumpeter's perspective of innovation, where innovation is seen as the commercial application of ideas or inventions (Schumpeter, 1934). However, some authors have a broad view of innovation as they include the creation of ideas in the entire innovation process (N. Anderson et al., 2014; Koen et al., 2002). From this broader perspective, service innovation can be defined as any change that affects one or more aspects of one or more service characteristics (Gallouj & Weinstein, 1997; Mu et al., 2019). This definition aligns with Schumpeter's general notion of innovations as “new combinations” (Schumpeter, 1934).

Existing research shows that innovativeness in an organization can be studied at the product level (Dabrowski, 2019; Heirati & Siahtiri, 2019; Mu et al., 2019) or the product program level (Atuahene-Gima et al., 2005; Chen & Arnold, 2022; Kang et al., 2014; Stock & Zacharias, 2013). In the first case, researchers focus on a specific product or service to investigate innovation within the organization, while in the second situation, the focus is on the product or service program level, also known as the organization level, to examine organizational innovativeness. Both these approaches are valuable, but some authors argue that studying innovativeness at the organization level can provide more insightful findings than studying it at the individual product or service level (Chen & Arnold, 2022; Siguaw et al., 2006; Stock & Zacharias, 2011). This may be because decisions regarding the entire program offered by an organization are strategic in nature and have long-term consequences (Cooper et al., 1999).

The existing literature on innovation primarily considers the uniqueness or novelty of a product or product program as the main indicator of innovativeness (e.g., Garcia & Calantone, 2002; Heirati & Siahtiri, 2019). In this perspective, innovativeness is defined as the degree of difference between new and existing offerings to either a firm or user group (Garcia & Calantone, 2002; Szymanski et al., 2007). However, in the past decade, a new research stream has emerged that incorporates two dimensions in the conceptualization of innovativeness (Chen & Arnold, 2022; Duan et al., 2020; Heirati & Siahtiri, 2019; Kang et al., 2014). The first dimension is the aforementioned uniqueness or novelty, and the second dimension is the meaningfulness (or usefulness) for users of a product or product program (Mu et al., 2019; Schultz et al., 2013). The addition of the meaningfulness dimension is based on the understanding that new products or services are primarily designed to satisfy user needs and wants. Therefore, meaningful benefits for users are seen as the central criterion for assessing product or service innovativeness (Heirati & Siahtiri, 2019; Stock & Zacharias, 2013).

In this study, we follow this research stream and conceptualize service program innovativeness using these two dimensions. Thus, we define service program innovativeness as the extent to which an organization's service program is new or novel and, at the same time, useful or meaningful to customers or users in comparison to what is already

available (Duan et al., 2020; Heirati & Siahtiri, 2019; Stock & Zacharias, 2013). These two dimensions are seen as distinct components of service program innovativeness (Stock & Zacharias, 2013).

Hospital performance

The assessment of an organization's performance can be based on various measures, as performance is a multidimensional concept (Liao et al., 2011; Rauch et al., 2009). Typically, these measures are divided into the following two groups: non-financial and financial (Rauch et al., 2009; Sainaghi et al., 2017). The first group includes measures that are not based on financial criteria, such as customer loyalty or organizational image (Kamboj & Rahman, 2015; Rauch et al., 2009; Kirca et al., 2005), while the second group comprises measures that are based on one or more financial criteria, such as total sales or profitability (Kamboj & Rahman, 2015).

In the context of a hospital's operation, the primary objective of a hospital is to provide medical care and treatment to individuals in need of healthcare services, and therefore, the key criterion for assessing a hospital is typically patient outcomes or the quality of patient care. Non-financial measures like patient satisfaction or clinical outcomes are commonly used for this evaluation (Donabedian, 1988). However, the financial aspects of a hospital's operation cannot be disregarded, as the quality of medical services provided by the hospital is dependent on its financial situation. A hospital with a strong financial standing typically delivers high-quality medical services, thus fulfilling well its mission to protect the public's health. Therefore, the overall financial performance of a hospital serves as an important measure of its outcomes, which is adopted in this study as a measure of assessing a hospital's performance.

HYPOTHESES DEVELOPMENT

We develop a theoretical framework, presented in Figure 1, to examine the independent effects of responsive and proactive market orientations on a hospital's financial performance through each dimension of service program innovativeness. We argue that: (i) responsive and proactive market orientations have distinct effects on the novelty and meaningfulness of a hospital's service program innovativeness, (ii) each of these two dimensions of service program innovativeness has an explicit effect on a hospital's financial performance, and (iii) each of the two dimensions mediates the impact of both a proactive and a responsive market orientation on a hospital's financial performance.

The proposed model of this study is based on the perspective of an organization's market orientation. According to this viewpoint, market orientation encompasses a culture and behaviors that lead to achieving better results than competitors (Crick, 2021; Kirca et al., 2005; Kohli & Jaworski, 1990; Narver & Slater, 1990). Higher results become possible when the organization can provide customers with greater value than competitors (Narver & Slater, 1990), assuming that customers, when choosing a product or service, are driven by the desire to obtain the highest possible value. The ability to offer the greatest value to customers is possessed by an organization that achieves a competitive advantage (Kumar et al., 2011; Na et al., 2019; Narver & Slater, 1990; Peteraf & Barney, 2003). This competitive advantage, created by developing a product of higher economic value than competitors, can be achieved through increasing benefits for customers or reducing product costs by the supplier (Narver & Slater, 1990; Peteraf & Barney, 2003).

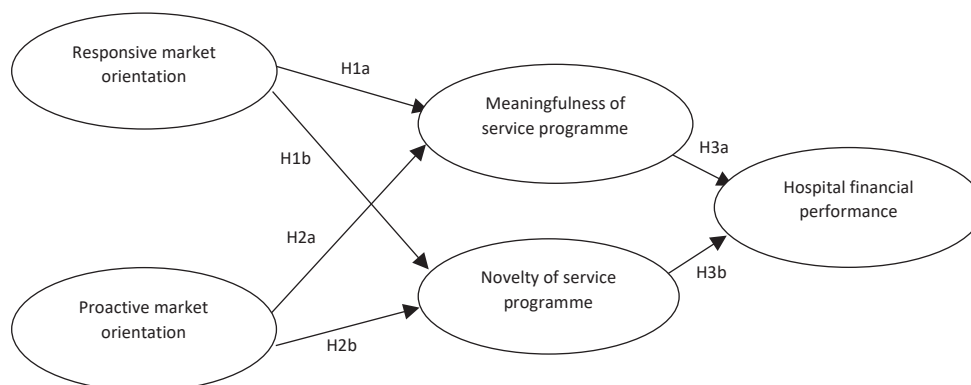


Figure 1. Conceptual model

H4a: Responsive market orientation → Meaningfulness of service program → Hospital financial performance.

H4b: Responsive market orientation → Novelty of service program → Hospital financial performance.

H5a: Proactive market orientation → Meaningfulness of service program → Hospital financial performance.

H5b: Proactive market orientation → Novelty of service program → Hospital financial performance.

Market orientation focuses primarily on providing customers with maximum benefits from using products or services according to their needs (Kohli & Jaworski, 1990). Both responsive and proactive market orientation, considering the expressed and latent customer needs, aim to satisfy these needs as fully as possible and offer customers the greatest benefits (Narver et al., 2004). Delivering such benefits to customers contributes to gaining a competitive advantage, enabling the creation of greater value for customers than competitors, and consequently achieving a better performance than rivals (Peteraf & Barney, 2003).

Buyers achieve the benefits they desire through the use of products and services. Therefore, market-oriented organizations focus on innovation, creating innovative products and services that aim to provide customers with the highest possible value (Atuahene-Gima et al., 2005; Han et al., 1998). As a result, both responsive and proactive market orientations may foster the development of innovative products and services (Narver et al., 2004), i.e., meaningful and novel, forming the organization's innovative product or service program.

Based on the above, it can be stated that both responsive and proactive market orientations of an organization lead to the creation of an innovative program of products and services, enabling the achievement of high results.

We theorize that the higher the level of responsive market orientation of a hospital, the greater both the meaningfulness and novelty of its service program. In terms of a responsive orientation, the task of a hospital is to acquire knowledge about the needs expressed by patients, and offer services that satisfy those needs (Atuahene-Gima et al., 2005; Narver et al., 2004; Petzold et al., 2019). These needs can be identified through classic medical interviews (anamnesis) or by employing certain marketing research methods (Kohli & Jaworski, 1990; Wang & Liu, 2020) (e.g., surveys, non-standardized interviews, exploration of forums, and healthcare dedicated websites). By using these methods, hospitals can gather information to broaden their knowledge about the current medical needs of patients (e.g., the current intensity of specific diseases or the emergence of new diseases), as well as knowledge concerning the improvement of overall patient care quality (e.g., implementing a mobile application for patients).

Knowledge about the needs expressed by patients serves as a basis for shaping a hospital's service program. On the one hand, based on this knowledge, the hospital can shape its services in a way that responds to these needs (Lonial et al., 2008; Narver et al., 2004). In this case, the hospital's service program will be characterized by a high level of meaningfulness for patients. On the other hand, the knowledge about expressed needs can be used to introduce new services that address the problems articulated by patients (Heirati & Siahtiri, 2019; Milfelner et al., 2019; Petzold et al., 2019). The development of such new medical services is often possible due to the utilization of the latest scientific and technological advancements (Iyer et al., 2021) (e.g., by developing new treatments for previously incurable ailments or diseases). In such cases, the application of a responsive market orientation will likely increase the novelty of the offered service program.

Due to the arguments presented above, we believe that a higher level of responsive market orientation of a hospital will be associated with higher meaningfulness and novelty of the services offered by the hospital. Therefore, we posit that:

H1: A hospital's responsive market orientation positively influences the meaningfulness (H1a) and the novelty of its service program (H1b).

We hypothesize that the higher the level of proactive market orientation of a hospital, the greater the meaningfulness and novelty of its service program. The essence of this orientation is to identify and satisfy the latent needs of patients, which are the needs that patients themselves are not aware of. However, such needs can be diagnosed (Atuahene-Gima et al., 2005; Narver et al., 2004). For this purpose, medical personnel can utilize medical observation of a patient, which includes the observation of various vital signs, physical signs, and laboratory test results to gather information about the patient's health needs. Additionally, these types of needs can be discovered by applying certain marketing research methods, such as projective techniques. These methods enable the acquisition of information and the expansion of knowledge (Wang & Liu, 2020) concerning a patient's latent needs, which can be utilized in shaping the hospital's service program within a proactive market orientation.

The medical services implemented by a hospital, aimed at satisfying patients' latent needs, are likely to be characterized by high meaningfulness and novelty. The meaningfulness of these services stems from the fact that they are designed to meet the real needs of patients, of which the patients themselves are unaware (Narver et al., 2004). Patients become aware of the meaningfulness of these services when they are offered them or when they use them. Through services that address patients' latent needs, a hospital makes these services useful for patients, thus resolving the patients' actual problems (Atuahene-Gima et al., 2005). Therefore, it is highly likely that with an increase in the hospital's implementation of a proactive market orientation, the meaningfulness of its service program will increase.

On the other hand, the novelty of medical services addressing patients' latent needs arises from the fact that they satisfy needs that patients are not conscious of (Milfelner et al., 2019; Narver et al., 2004). As a result, these services are unknown to patients and more challenging for competing hospitals to discover. Therefore, from the perspective of patients and competing hospitals, such services will provide unique benefits (Kocak et al., 2017) and will be perceived as new, as they address certain unrecognized or, in other words, new needs. Thus, it is highly likely that with an increase in the proactive market orientation of a hospital, the novelty of its service program will also increase.

Taking into consideration the above arguments regarding the relationships between the implementation of a proactive market orientation in a hospital and the meaningfulness and novelty of its service program, the following research hypothesis is proposed:

H2: A hospital's proactive market orientation positively influences the meaningfulness (H2a) and novelty (H2b) of its service program.

Each of the two dimensions of service program innovativeness performs a specific function in influencing patient behavior and, consequently, the financial results of a hospital. The first dimension, which is the meaningfulness of the program, means that the services provided by the hospital are appropriate and beneficial for patients (Heirati & Siahtiri, 2019), which is essential for maintaining their health. At the same time, offering patients a comprehensive portfolio of medical services is important due to the interconnections and complexity of these services (Schultz et al., 2019). Therefore, an increase in the meaningfulness of the service program is likely to impact a patient's decision to choose the hospital as a place of treatment, which, in turn, can have a positive effect on the hospital's financial performance. The second dimension, which is the novelty of the service program, allows the hospital's services to stand out from the competition and attract the attention of potential patients (Schultz et al., 2019). The novelty of the medical service portfolio can be perceived as a sign of innovation (Heirati & Siahtiri, 2019; Mu et al., 2019), which serves as a signal (Stock, 2011) directed towards potential patients. This signal communicates that the hospital offers new medical services that are typically more effective than traditional ones (Mu et al., 2019; Schultz et al., 2019). Therefore, the novelty of a hospital's service program can have a positive impact on the patients' choice of hospital, which is likely to contribute to achieving good financial results for the hospital (Zuo et al., 2019).

In the case of products, a negative impact of their novelty on customers' purchase decisions has been observed, stemming from the fact that as the product novelty increases, its unfamiliarity among potential customers also increases (Nakata et al., 2018). However, it can be expected that this negative effect does not occur in the case of new medical services for two reasons. Firstly, medical services are typically complex and require specialized equipment and skills, therefore, the level of unfamiliarity with current and innovative services among patients is likely to be similar (Berry & Bendapudi, 2007). Secondly, patients are served by professionals, so even a high level of unfamiliarity with a service does not hinder the delivery of excellent care. Therefore, we assume a positive impact of the novelty of a hospital's service program on its financial performance. Thus, considering both the dimensions of service program innovativeness, we posit the following hypothesis:

H3: Service program meaningfulness (H3a) and novelty (H3b) positively affect the financial performance of a hospital.

So far, only the direct effects included in our conceptual model have been considered. Now, we focus on the potential indirect effects arising from this model. These indirect effects relate to the influence of a specific market orientation of a hospital – responsive or proactive – on its financial results through one of the two dimensions of innovativeness in a hospital service program, namely, the meaningfulness or novelty of the program. The existence of these indirect

relationships is supported by the previously presented arguments regarding the hypotheses formulated thus far as well as by the existing literature.

The premise for the existence of these indirect relationships, in addition to the previously presented arguments regarding the formulated hypotheses, is the results of previous studies. The literature review indicates that the mediating role of innovation in the impact of market orientation on organizational outcomes has already been investigated (Bamfo & Kraa, 2019; Han et al., 1998; Kocak et al., 2017; Migdadi et al., 2017). These studies revealed the following effects: a positive impact of market orientation on organizational performance through innovation (Han et al., 1998), a positive influence of orientation on customers and inter-functional integration on this performance through innovation (Bamfo & Kraa, 2019), a positive impact of both responsive and proactive market orientations on organizational performance through both radical and incremental innovations (Kocak et al., 2017), and a positive impact of orientation on customers and competitors on this performance through innovation capabilities (Migdadi et al., 2017).

Hypotheses H1 and H2 respectively link the market orientation of a hospital – responsive and proactive – with each of the two dimensions of its service program innovativeness, while hypothesis H3 relates these dimensions to the hospital’s financial results. Therefore, it is likely that a hospital’s financial results are indirectly related to the implementation of a specific market orientation through each of the two dimensions of service program innovativeness. Considering the earlier arguments supporting hypotheses H1, H2 and H3, the following hypotheses were formulated:

H4: A responsive market orientation positively and indirectly affects the financial performance of a hospital through its service program meaningfulness (H4a) and its novelty (H4b).

H5: A proactive market orientation positively and indirectly affects the financial performance of a hospital through its service program meaningfulness (H5a) and its novelty (H5b).

METHODOLOGY

Sample and procedure

Our research focused on hospitals operating in Poland. We used the official Polish register, known as the Register of Entities Performing Medicinal Activities, to construct our sampling frame. From this sampling frame, we randomly selected a sample of 600 hospitals using a simple random sampling technique. Subsequently, we contacted the general or medical managers of each selected hospital via phone to explain the purpose of the research and invite their participation in our survey. As an incentive to participate, we offered the managers a report containing the results. Following the initial contact, we sent an email to the hospital managers containing a link to the questionnaire. We received 204 valid responses out of the 600 questionnaires sent, resulting in a response rate of 34%. The survey was conducted during the first half of 2018.

As presented in Table 1, the hospitals in our sample were characterized based on their type, public or non-public status, annual budget, and total number of employees. In terms of hospital type, the majority of hospitals were multi-specialty hospitals (46.6%), followed by general hospitals (28.8%) and mono-specialty hospitals (24.6%). The majority of hospitals in the sample were public hospitals (72.6%), while the remaining hospitals were non-public (27.4%). The median annual budget of the surveyed hospitals ranged from PLN 30 million (about 6.5 million euros) to PLN 100 million (about 22 million euros), and the median number of employees was between 300 and 500.

Table 1. Sample characteristics

Characteristics	Number	Percent	Characteristics	Number	Percent
<i>Type</i>			<i>Status</i>		
general	59	28.8%	public	148	72.6%
multi-specialty	95	46.6%	non-public	56	27.4%
mono-specialty	50	24.6%			
<i>Number of employees</i>			<i>Annual budget in PLN million</i>		
<300	72	35.1%	<30	88	43.3%
300-500	49	24.0%	30-100	71	34.6%
501-700	20	9.6%	100-150	18	8.7%

Characteristics	Number	Percent	Characteristics	Number	Percent
701-900	16	7.7%	>150	27	13.5%
901-1100	15	7.2%			
>1100	32	16.3%			

Information regarding the structure of the national hospital population in terms of their status (public vs. non-public) was available for us, while information about other characteristics from Table 1, related to the considered population, was not. In 2018, there were 949 hospitals in Poland (Polish Statistical Office, 2024), with about 70% being public hospitals (including local government entities), and 30% being non-public hospitals (*Private hospitals in Poland*, 2023). We conducted a chi-square goodness-of-fit test to assess the distribution of hospital status in our study. According to Table 1, the observed frequencies in the two categories, public and non-public, were 148 and 56 units, respectively. The chi-square statistic was 0.585 with degrees of freedom $df = 1$, resulting in a p-value of 0.444. At the 0.05 significance level, the test result is not statistically significant, suggesting no differences between the observed and expected distributions.

Measures

We applied established items from the literature to measure all of the constructs. For both responsive and proactive market orientations, we employed four items from Narver et al. (2004). To assess the constructs representing service program innovativeness, namely meaningfulness and novelty, we utilized the scales developed by Im and Workman (2004). All items were rated on a seven-point Likert scale, ranging from 1 (strongly disagree) to 7 (strongly agree). The measurement of the financial performance of the hospitals included three items adapted from (Grissemann et al., 2013; Zhou et al., 2009). These items were rated on a seven-point scale, ranging from 1 (far below planned) to 7 (far above planned).

The indicators utilized in the questionnaire to measure the considered constructs are presented in Table 2 in the form of statements on a Likert scale. Meanwhile, the characteristics of the questionnaire used to describe the research sample are presented in Table 1, including type, status, number of employees, and the hospital's annual budget.

Data analysis

We analyzed the data in two steps, according to Anderson and Gerbing (1988). First, we used a confirmatory factor analysis (CFA) to test the measurement model, and second, we verified the research hypotheses using structural equation modeling (SEM). Though there is no consensus on the recommended sample size for structural equation modeling, a sample of 204 units can be considered as sufficient for this research in terms of the model's complexity (i.e., five constructs) and its essential characteristics (Hair et al., 2014). We applied the Mplus v.8.1 statistical software (Muthén & Muthén, 2012) to perform the CFA and SEM analyses. This software is relevant for this study because it allows the testing of several indirect effects included in one parallel multiple mediator model (Hayes & Rockwood, 2017) and offers a mean-adjusted maximum likelihood estimator (MLM), which is robust to data non-normality (Muthén et al., 2016).

According to Baron and Kenny (1986 p. 1173), mediation is a “mechanism through which the focal independent variable is able to influence the dependent variable of interest”. Variable M acts as a mediator when it is causally located between the independent variable X and the dependent variable Y . In such cases, X influences Y because X affects M , and this effect is transmitted to Y through M as M influences Y (Hayes & Rockwood, 2017). This basic mechanism explains the indirect effect of X on Y through the mediator M and it is described by a simple mediation model. However, some causal relationships involve more than one mediator, leading to the application of a multiple mediator model. When these mediation mechanisms occur “in parallel,” a parallel multiple mediator model describes such causal relationships (Hayes, 2013; Jose, 2013).

The conceptual model of our study includes two parallel multiple mediator models. The first model focuses on responsive market orientation as the independent variable, while the second model features proactive competitor orientation. Both models include two parallel mediators, namely the novelty and the meaningfulness of service program innovativeness, and the dependent variable in each model is the hospital's financial performance. To examine the indirect effects, we tested the product of the effects that constitute each indirect effect within one multiple mediator model, following the approach of Hayes and Rockwood (2017). Structural equation modeling was employed to estimate our conceptual model, as it is considered the best method in this case (Jose, 2013).

No severe deviation from univariate normality was observed in the data, as the univariate skewness and kurtosis estimates of all indicators were lower than the normality thresholds of 7 for kurtosis and 3 for skewness (Nevitt & Hancock, 2000). Nevertheless, the data showed substantial multivariate kurtosis. The estimate of Mardia's normalized multivariate kurtosis was 98.15, and values of this estimate greater than 5 indicate non-normal distributed data (Bentler, 2005). Consequently, to analyze the data, we applied the MLM estimator, which is robust to data non-normality.

In accordance with Jose (2013), Kline (2012), and Muthén et al. (2016), a residual covariance between the two mediators was included in the structural model. The reason for this is that these mediators cover two aspects of the same domain – namely, program service innovativeness – therefore, they share at least one omitted cause, such as, for example, professional medical knowledge. Moreover, one control variable was used in the analysis – hospital size, expressed by the number of employees – to avoid the confounding problem of endogenous variables.

RESULTS

Measurement model

The CFA model involved the five constructs listed in Table 2. Each of them was measured by three or four indicators. Additionally, following a recommendation provided by Brown (2015), a single indicator of the number of employees was included in the CFA model because we used this variable in the structural model as a control one. It was assumed that the number of employees was measured without error, therefore, the error variance of this variable was fixed at zero (Brown, 2015). This operation was performed to avoid a specification error in the structural model.

Table 2. Constructs and results of confirmatory factor analysis

Latent variables	Indicators	λ	t-Value
Responsive market orientation	We constantly monitor our commitment and orientation to meet the needs of patients.	0.898	47.800
	We provide information about good and bad feelings of patients to all departments.	0.829	27.761
	Our competitive advantage strategy is based on understanding the needs of our patients.	0.799	22.739
	We systematically and often examine the satisfaction of our patients.	0.722	17.408
Proactive market orientation	In our hospital, we try to anticipate the expectations of our patients.	0.919	67.294
	In our hospital, we are constantly trying to discover the additional needs of our patients, which they are not aware of.	0.905	51.914
	In the field of new services, we introduce solutions that take into account the unexpressed needs of our patients.	0.864	36.582
	We look for opportunities and opportunities in areas where patients have had difficulty expressing their needs.	0.854	42.705
Meaningfulness of service program	Compared to your competitors, your service program: is relevant to customers' needs and expectations.	0.910	53.228
	is considered suitable for customers' desires.	0.972	128.265
	is appropriate for customers' needs and expectations.	0.947	92.164
	is useful for customers.	0.728	14.309
Novelty of service program	Compared to your competitors, your service program: is truly 'out of the ordinary'.	0.911	70.160
	can be considered as revolutionary.	0.940	107.572
	is stimulating.	0.947	104.965
	show an unconventional way of solving problems.	0.937	90.419
Hospital financial performance	To what extent are the results of your hospital in line with those planned in terms of: sales revenues?	0.707	14.657
	occupancy?	0.982	61.660
	gross operating profit?	0.924	53.930

λ – Standardised loadings.

The measurement model indicated a good fit to the data: $\chi^2 (156) = 245.780$, $p < 0.001$; root mean square error of approximation (RMSEA) = 0.053; standardized root mean square residual (SRMR) = 0.044; Tucker-Lewis index (TLI) = 0.968; comparative fit index (CFI) = 0.974; $\chi^2/df = 1.58$. We also used a chi-square test to assess the fit of the model. According to (West et al., 2012), this test is sensitive to the sample size, therefore, other fit indices, which are recommended for the MLM estimator, were applied (West et al., 2012). These indices met the required standards for a good fit: a RMSEA value of 0.06 or less, an SRMR value of 0.08 or less, TLI and CFI values of 0.95 or higher, and an χ^2/df value of 5 or less (Hu & Bentler, 1999; West et al., 2012). The estimates of the standardized loadings of all items are significant (the lowest t -value is 14.66) and greater than 0.70 (Hair et al., 2014). The average variance extracted (AVE) is higher than the 0.5 threshold (Fornell & Larcker, 1981) for each of the five constructs, as shown in Table 3. Altogether, these results point out an adequate convergent validity of the measurement model.

The discriminant validity of the measurement model was evaluated by calculating the square root of the AVE for the constructs. The outcomes are shown in Table 3, in which the values of the square root of the AVE are shown in cells diagonally and the construct correlations are given in off-diagonal cells. The results presented in Table 3 provide proof of adequate discriminant validity (Fornell & Larcker, 1981), as for each construct, the square root of the AVE is higher than the highest correlation among the latent factors involving the focal factor.

Table 3. Construct correlations and discriminant validity

	CR	AVE	1	2	3	4	5
1. Responsive market orientation	0.887	0.663	0.814				
2. Proactive market orientation	0.936	0.785	0.789	0.886			
3. Meaningfulness of service program	0.941	0.800	0.738	0.762	0.894		
4. Novelty of service program	0.965	0.872	0.463	0.597	0.581	0.934	
5. Hospital financial performance	0.909	0.773	0.226	0.290	0.272	0.278	0.879

Note: Off-diagonal: construct correlations; along-diagonal: square root of AVE; for all correlations $p < 0.001$. CR – Construct reliability; AVE – Average variance extracted.

The construct reliabilities were evaluated by computing the composite reliability (CR) measure. Table 3 shows the CR values, and all of them are above the recommended level of 0.7, which displays the internal reliability of the constructs (Bagozzi & Yi, 2012). Overall, we can conclude that the measurement model is acceptable.

Hypotheses testing

The structural model displayed in Figure 1 demonstrated an acceptable fit to the data: $\chi^2 (158) = 246.935$, $p < 0.001$; SRMR = 0.046; RMSEA = 0.053; CFI = 0.974; TLI = 0.969; $\chi^2/df = 1.56$.

The results of testing hypotheses H1a – H3b are given in Table 4. First, the outcomes of the relationships between the two market orientations under investigation and the two dimensions of service program innovativeness are as follows. There was a positive relationship between responsive market orientation and service program meaningfulness ($\beta = 0.354$, $p < 0.001$), whereas, contrary to our expectations, there was no such link between this market orientation and service program novelty ($\beta = -0.044$, $p > 0.05$). These findings support hypothesis H1a but not H1b. Regarding the relationships between proactive market orientation and both dimensions of service program innovativeness, the results reveal that this type of market orientation positively affects both the meaningfulness ($\beta = 0.482$, $p < 0.001$) and the novelty ($\beta = 0.629$, $p < 0.001$) of the service program. Therefore, both hypotheses H2a and H2b are supported. Second, Table 4 demonstrates that service program meaningfulness ($\beta = 0.168$, $p < 0.05$) as well as its novelty ($\beta = 0.192$, $p < 0.05$) are positively related to hospital financial performance. Thus, both H3a and H3b are supported.

Table 4. Direct effects and results of testing hypotheses H1a – H3b

Effect	Estimate (standardised)	p-value	Hypotheses' verification
H1a: Responsive market orientation → Meaningfulness of service program	0.354	0.000	Supported
H1b: Responsive market orientation → Novelty of service program	-0.044	0.737	Not supported
H2a: Proactive market orientation → Meaningfulness of service program	0.482	0.000	Supported
H2b: Proactive market orientation → Novelty of service program	0.629	0.000	Supported

Effect	Estimate (standardised)	p-value	Hypotheses' verification
H3a: Meaningfulness of service program → Hospital financial performance	0.168	0.032	Supported
H3b: Novelty of service program → Hospital financial performance	0.192	0.015	Supported

Table 5 shows that, on the one hand, a responsive market orientation had a significant, positive indirect effect on hospital financial performance through the meaningfulness of the service program ($\beta = 0.059, p < 0.05$), supporting H4a; on the other hand, such an orientation did not have a significant, indirect effect on the performance through the novelty of the service program ($\beta = -0.008, p < 0.05$), hence not supporting H4b. However, in the case of a proactive market orientation, the outcomes were the opposite, as there was not a significant relationship between this type of market orientation on hospital financial performance through service program meaningfulness ($\beta = 0.081, p > 0.05$), but this orientation was positively related to hospital financial performance through service program novelty ($\beta = 0.121, p < 0.05$). Hence, our H5b is supported while H5a is not.

Table 5. Indirect effects and results of testing hypotheses H4a – H5b

Effects of responsive and proactive market orientation constructs on hospital financial performance	Estimate (Standardised)	p-value	Hypotheses' verification
<i>Effects of a responsive market orientation on a hospital's financial performance</i>			
<i>Specific indirect effects</i>			
H4a: Responsive market orientation → Meaningfulness of service program → Hospital financial performance	0.059	0.048	Supported
H4b: Responsive market orientation → Novelty of service program → Hospital financial performance	-0.008	0.744	Not supported
<i>Effects of a proactive market orientation on a hospital's financial performance</i>			
<i>Specific indirect effects</i>			
H5a: Proactive market orientation → Meaningfulness of service program → Hospital financial performance	0.081	0.066	Not supported
H5b: Proactive market orientation → Novelty of service program → Hospital financial performance	0.121	0.034	Supported

Regarding the relationships between the control variable and the endogenous variables of the conceptual model, the outcomes showed that the number of hospital employees was only positively related to service program novelty ($\beta = 0.173, p < 0.001$), and there were no significant relationships between this control variable and the other two endogenous variables, i.e., service program meaningfulness ($\beta = 0.052, p > 0.05$) and hospital financial performance ($\beta = -0.059, p > 0.05$).

DISCUSSION

The obtained results indicate that a hospital's implementation of a responsive market orientation has a positive impact on the meaningfulness of its service program (H1a). However, contrary to the assumptions of the authors, the same cannot be said about the novelty of this program (H1b). Consequently, it cannot be stated that a responsive market orientation supports innovations within the organization because its implementation does not affect the novelty of the service program. Our results indicate that with an increase in the implementation of a responsive market orientation, only the meaningfulness of a hospital's service program increases (H1a). This relationship can be justified by the fact that a greater adoption of a responsive market orientation in a hospital results in a stronger focus on understanding and meeting the needs expressed by patients, which leads to the introduction of services that satisfy those needs. As a result, the medical service program becomes increasingly meaningful for patients. This result is consistent with the findings of Blocker et al. (2011) and Heirati and Siahtiri (2019). However, the comparison of our result to the results of these studies is limited because the first study found a positive effect of a responsive customer orientation on customer value, while the second study found a positive impact of customer collaboration on the meaningfulness of a new service.

Our findings indicate the lack of a relationship between the novelty of the medical service program and a hospital's implementation of a responsive market orientation (H1b). This means that the hospital's understanding and fulfillment of patients' expressed needs does not lead to an increase in the novelty of its service program. This situation can be explained by the fact that the development of medical services based on patients' expressed needs primarily involves improving and modifying existing services. As a result, newly developed medical services in this manner exhibit relatively low novelty. However, Heirati and Siahtiri (2019) observed a positive impact of customer collaboration on the novelty of a new service,

which is not consistent with our result. The difference between the findings of these researchers and ours may stem from two reasons. Firstly, customer collaboration does not fully capture the essence of a responsive market orientation. Secondly, the mentioned study was conducted at the level of a specific service, while ours focused on the level of a service portfolio.

The outcomes of the work indicate that with an increase in a hospital's implementation of a proactive market orientation, both the meaningfulness (H2a) and novelty (H2b) of its service program increase, respectively, thus, the implementation of a proactive market orientation supports innovations in the organization. These results are consistent with our expectations and confirm previous assumptions that the acquisition of unique knowledge about hidden patient needs contributes to the creation of a meaningful and novel hospital service program. Latent needs are real but unknown to the patients themselves. Their actual existence makes the corresponding medical services meaningful from the patients' perspective. However, the lack of patient awareness regarding the existence of these types of needs, results in the services that meet those needs being perceived as novel. Consequently, it can be concluded that the more intensively the hospital adopts a proactive market orientation, the more meaningful and novel its service portfolio becomes.

Our result regarding the relationship between a proactive market orientation and the meaningfulness of the service program (H2a) corresponds to the finding obtained by Blocker et al. (2011), who demonstrated that the application of a proactive market orientation positively influences customer value. As for the result concerning the relationship between a proactive market orientation and service program novelty (H2b), it is consistent with the study conducted by Kocak et al. (2017), who observed that the implementation of a proactive market orientation leads to radical innovation. However, comparing the results of our study to the previously mentioned research is limited since the dependent variables used in those studies represent an approximation of the two dimensions of service portfolio innovativeness examined in our research.

As for the relationships between the two dimensions of service program innovativeness and a hospital's financial performance, the obtained results confirm our assumptions. An increase in both the meaningfulness (H3a) and novelty (H3b) of a hospital's service program has a positive impact on its financial performance. In terms of meaningfulness, this is due to the fact that the more useful the portfolio of services offered by the hospital is for patients, the more likely they will choose it as a place for treatment, examination, or procedure. Similarly, the novelty of the medical service portfolio can positively influence the choice of hospital, as it is essential to attract patients' attention and serves as a signal that the hospital's medical services are likely to be more effective than traditional ones. Therefore, an increase in both the meaningfulness and novelty of a hospital's service program will contribute to a growth in both the number of patients and the number of services performed by the hospital. These increases, in turn, should have a positive impact on a hospital's financial situation because private hospitals should have higher revenues and profits, while public hospitals will benefit from increased funding from the National Health Fund.

Regarding the impact of service program meaningfulness on the financial performance of a hospital (H3a), similar results were obtained in studies conducted by Chan and Cho (2022), Duan et al. (2020), and Im and Workman (2004). The results of these studies indicate that the meaningfulness of new products positively affects a company's financial performance (Chan & Cho, 2022; Im & Workman, 2004) and the company's competitive advantage (Duan et al., 2020). Concerning the influence of service program novelty on the financial performance of a hospital (H3b), Duan et al. (2020) demonstrated a positive effect of the novelty of a new product on the competitive advantage of a company, which is consistent with the findings of our study. However, Chan and Cho (2022), and Workman (2004) did not observe the effect of the novelty of a new product on a company's financial performance. Nevertheless, the comparison of our results with the findings of these previous studies is limited because they focused on physical products, not services, and some of them were conducted at the level of individual products (Chan & Cho, 2022; Im & Workman, 2004) rather than the entire product portfolio.

In the context of the obtained results, the implementation of a responsive market orientation by a hospital positively influences its financial situation through the meaningfulness of the hospital's service program (H4a). This means that the results of our study support the following indirect mechanism: as the implementation of a responsive market orientation by a hospital increases, the meaningfulness of its service program also increases, which, in turn, positively affects the hospital's financial performance. The positive value of this indirect effect arises from the observed two direct effects: the positive impact of the application of a responsive market orientation on the meaningfulness of the service portfolio (H1a) and the positive influence of the latter on the financial performance of the hospital (H3a). Therefore, the arguments presented earlier regarding these two direct effects justify the hypothesis that a responsive market orientation positively and indirectly affects the financial performance of a hospital through the meaningfulness of its service program (H4a).

However, the lack of confirmation by our results of the indirect effect – hypothesizing that a hospital’s implementation of a responsive market orientation positively affects its financial performance through the novelty of its service portfolio (H4b) – most likely stems from a statistically insignificant and close-to-zero direct effect of a hospital’s use of a responsive market orientation on the novelty of its service program ($\beta = -0.044$, $p > 0.05$). Furthermore, the reasons previously cited as causes for this insignificant direct effect likely also influence the absence of the indirect effect considered. Therefore, our results suggest that the novelty of a hospital’s service program does not act as a mediator in the relationship between a hospital’s use of a responsive market orientation and its financial performance.

Our findings confirm the indirect effect, positing that a proactive market orientation of a hospital impacts its financial performance through the novelty of its service program (H5b). This means that our study supports the existence of the following indirect mechanism: as a hospital’s implementation of a proactive market orientation increases, the novelty of its service program also increases, positively influencing the financial performance of the hospital. The positive value of this indirect effect results from the two direct effects: the positive influence of the application of a proactive market orientation on the service program novelty (H2b) and the positive impact of the latter on the financial performance of the hospital (H3b). Thus, the previously presented arguments supporting these direct effects can be considered reasons that justify the indirect effect.

In turn, the lack of confirmation of the hypothesized indirect effect – assuming a positive impact of a proactive market orientation on the financial performance of a hospital through the meaningfulness of its services (H5a) – is due to the fact that the product of the direct effects contributing to this indirect effect does not reach statistical significance. Nevertheless, the value of this indirect effect is positive and close to the critical level of statistical significance ($\beta = 0.081$, $p = 0.066$), indicating that this effect could be subject to further research.

The results regarding the above indirect effects were not compared to the findings of other studies because these types of effects have not been previously investigated, to the best of the authors’ knowledge, neither within products nor services.

CONCLUSIONS

The theoretical contribution of the study lies in explaining the relationships between the implementation of a specific market orientation, service program innovativeness, and the financial performance of a hospital. Both direct and indirect relationships regarding these three issues were presented. Considering the direct relationships, the following dependencies were observed. Firstly, a hospital’s adoption of a responsive orientation has a positive impact on the meaningfulness of its service program. Secondly, the adoption of a proactive orientation has a positive impact on both the meaningfulness and novelty of such a program. Thirdly, both the meaningfulness and novelty of a hospital’s service program have a positive influence on the hospital’s financial performance.

With regard to the indirect relationships, the occurrence of two mediating mechanisms was observed. In the first mechanism, a hospital’s implementation of a responsive market orientation positively affects its financial situation through the meaningfulness of its service program. In the second mechanism, a hospital’s adoption of a proactive orientation also positively affects its financial situation, but through the novelty of its service program.

Furthermore, in terms of a theoretical contribution, the results of our study suggest the presence of two phenomena. The first one indicates that a hospital’s implementation of a responsive market orientation does not have a positive influence on the novelty of its service program. The second phenomenon pertains to the fact that a hospital’s adoption of a proactive market orientation does not have a positive impact on its financial performance through the meaningfulness of its service program. This phenomenon occurs despite the presence of two direct relationships: (i) the adoption of a proactive market orientation has a positive effect on the meaningfulness of the service program, and (ii) this meaningfulness positively influences the hospital’s financial performance. The lack of the mentioned mediating effect comes from the fact that the product of the direct effects, which contribute to the examined indirect effect, is not statistically significant (Hayes & Rockwood, 2017). Consequently, it was not observed that the meaningfulness of a hospital’s service program mediates the impact on its financial performance of the hospital’s adoption of a proactive market orientation.

Based on our study, various practical implications can be drawn. They can be presented in the following two aspects: the creation of an innovative service program by a hospital and the building of a strong financial situation for the hospital. When it comes to creating an innovative service program, high meaningfulness can be achieved through both a responsive and proactive market orientation. However, achieving a high level of program novelty requires solely the application of a proactive orientation. Therefore, if a hospital aims to achieve high meaningfulness in its service program,

it should understand and fulfill both expressed and latent patient needs. If the goal of the hospital is to achieve a high level of novelty in its service program, it should focus on recognizing and satisfying latent patient needs. Recognizing the expressed needs of patients is relatively easy as information about these needs can be directly obtained from patients using various methods, including interrogation-based methods (e.g., medical interviews, surveys). However, identifying latent needs can be more challenging as patients themselves are not aware of them. To recognize these needs, the use of patient medical observation and specialized methods such as projective techniques can be recommended.

Referring to a hospital achieving a good financial situation, it can be created both directly through an innovative service program and indirectly through the application of a specific market orientation. In the first case, hospitals can be advised to develop an innovative service program characterized by both high meaningfulness and novelty, as this will contribute to achieving good financial results. High meaningfulness of the program is essential to provide the appropriate benefits for patients, while its novel nature will attract patients' attention and confirm the hospital's modernity. In the second case, the shaping of a hospital's good financial situation occurs indirectly through the application of the appropriate market orientation, which, in turn, affects the hospital's financial position. Our recommendations in this regard are as follows: good financial results for a hospital can be achieved by applying both a responsive and a proactive market orientation. However, if a hospital adopts a responsive market orientation, it should strive to achieve a high level of service program meaningfulness, which will contribute to improving its financial situation. On the other hand, if a hospital applies a proactive market orientation, it should aim to create a service portfolio characterized by high novelty, as this will contribute to achieving a good financial condition.

The implementation of both responsive and proactive market orientations by hospitals is associated with specific social implications. Our research indicates that a responsive orientation of a hospital leads to an increase in the meaningfulness of its service program, while a proactive orientation contributes to an increase in both the meaningfulness and novelty of this portfolio. The social implications resulting from the application of these orientations are similar because adapting a hospital's service program to the needs of patients, both expressed and latent, translates into an improvement in the overall health level of the community, thereby influencing the overall well-being of the population.

Our study also suggests that the growth in both the meaningfulness and novelty of a hospital's service program positively affects its financial results, which may have significant social implications. Improving the financial situation of a hospital enables this entity to fulfill more fully its social mission, which is to provide healthcare at the highest level for the community. Additionally, the favorable financial condition of the hospital translates into high concern for the employment conditions and work of hospital staff, as well as the creation of new job opportunities, demonstrating care for local communities.

Our study has certain limitations, which are presented below, along with directions for future research. Firstly, the study focused on selected determinants of a hospital's financial performance, namely two dimensions of service program innovativeness, and responsive and proactive market orientations of hospitals, as we aimed to achieve a parsimonious research model (Hair et al., 2014). However, there are other variables that determine the mentioned outcomes, such as service quality or the qualifications of medical staff. Therefore, future research may consider other potential variables as determinants of a hospital's financial performance. Secondly, our study had a cross-sectional design, which limits the ability to test causal relationships. However, the relationships examined in our study were based on specific theory and substantive arguments. Nonetheless, our model could be subject to longitudinal testing in the future. Thirdly, the measurement of the novelty and meaningfulness of the service program in our study relied on the opinions of hospital managers, not patients. This approach was chosen because the scales used to measure the novelty and meaningfulness of the service program were developed to be applied among managers (Im & Workman, 2004). The authors of these scales, S. Im and J.P. Workman, tested both scales with both managers and customers. The results of this testing indicated high and statistically significant correlations between the results obtained from the two tested groups (Im & Workman, 2004), suggesting that measuring the novelty and meaningfulness of the service program among managers is reliable. Fourthly, the measurement of a hospital's financial results relied on the measurement of managers' perceptions through a latent variable. Obtaining objective information concerning these results (e.g., revenues, costs, profitability) would be very difficult or impossible. However, research findings indicate a high correlation between measurements of managers' perceptions of financial results and objective measures (Atuahene-Gima & Li, 2004), which is why many researchers rely on this first approach (Im & Workman, 2004; Kocak et al., 2017; Lee et al., 2015; Nakata et al., 2018). Lastly, the study was conducted in one country, thus, the obtained results pertain to the population of Polish hospitals. In future research, our model could be tested in other countries.

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Biographical notes

Dariusz Dąbrowski is an Associate Professor at Gdansk University of Technology. His scientific interests have focused on problems related to the management of product innovation as well as the market orientation of organizations. His recent research concerns issues related to the creativity and application of market knowledge in new product development within high-technology companies, the implementation of market orientation and marketing programs in hotels, and achieving a competitive advantage based on new products. He has participated in many research projects implemented at academic centers and in projects requested by industry.

Wioletta Kukier is a PhD student at the Faculty of Management and Economics of Gdańsk University of Technology. She is interested in the issues of market orientation and its practical use in organizations (commercial and non-profit). Before starting her academic work, she worked in marketing departments in international corporations and family businesses, dealing with, among others, the development and implementation of marketing strategies for new products and entire organizations.

Anna Tybińska is a PhD candidate at Gdansk University of Technology. Her scientific interests have focused on problems related to the management of service innovation as well as the market orientation of organizations. Her recent research concerns issues related to the implementation of market orientation and marketing programs in hospitals, hospital-based health technology assessment, and the quality of hospital services. She also has experience as a healthcare manager.

Authorship contribution statement

Dariusz Dąbrowski: Conceptualization, Formal Analysis, Literature Investigations, Methodology, Project Administration, Resources, Software, Supervision, Validation, Visualization, Writing Original Draft, Writing - Review & Editing. **Wioletta Kukier:** Data Curation, Literature Investigation, Writing Original Draft. **Anna Tybińkowska:** Data Curation, Literature Investigation, Writing Original Draft.

Conflicts of interest

The authors declare no conflict of interest.

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Does ESG performance have an impact on financial performance? Evidence from Turkey

Melih Sefa Yavuz¹ , Hasan Sadık Tatlı² , Gözde Bozkurt³ , Gökten Öngel⁴ 

Abstract

PURPOSE: Stakeholders such as consumers, nongovernmental organizations, and public institutions have increasingly pressured companies to adopt corporate social responsibility (CSR) policies. This trend has led to the integration of environmental, social, and governance (ESG) reporting into business strategies to achieve long-term competitive advantages and enhance financial performance. ESG reporting has become a critical tool for measuring corporate CSR efforts, contributing to the institutionalization of nonfinancial reporting standards. This study aims to determine how the adoption of ESG sub-dimensions affects the financial performance of companies in Turkey. **METHODOLOGY:** The study employed panel regression analysis on data from 21 companies listed in the Borsa Istanbul-100 index over the period 2011–2020 to investigate the relationship between ESG sub-dimensions and firm performance. **FINDINGS:** The findings indicate that adopting the environmental and governance sub-dimensions positively affects ROE and Tobin's Q. However, the adoption of the governance sub-dimension negatively impacts Tobin's Q while positively influencing ROE. No statistically significant results were found regarding the impact of ESG sub-dimensions on firms' ROA ratios. **IMPLICATIONS:** The results of the research, based on the example of Turkey, are important to determine how companies' social responsibility strategies in developing countries provide them with outputs in terms of environment, social and governance and whether social responsibility-based activities are truly sustainable strategy for companies in developing countries. The findings highlight the importance of considering the macroeconomic structure, legal system, and financial development of countries when evaluating CSR activities. The regulatory environment plays a significant role, as weaker legal protections can negatively affect the relationship between governance practices and firm performance. For practitioners, the insights suggest prioritizing environmental investments and carefully strategizing governance practices to align with investor expectations and regulatory frameworks. **ORIGINALITY AND VALUE:** By focusing on the BIST 100 companies, this study contributes to the limited literature on the role of ESG sub-dimensions in shaping financial performance in developing markets. This research provides valuable insights into how environmental, social, and governance practices specifically impact the financial outcomes of firms in Turkey, offering a nuanced understanding that can inform both academic discussions and practical strategies in similar contexts.

Keywords: corporate social responsibility, ESG performance, Financial performance, Panel data analysis, BIST 100.

1 Melih Sefa Yavuz, Ph.D., Assistant Professor, Department of Finance and Banking, Istanbul Beykent University, Cumhuriyet Mahallesi, Beykent, Büyükçekmece, Istanbul, e-mail: sefayavuz@beykent.edu.tr (ORCID: <https://orcid.org/0000-0003-1085-5304>).

2 Hasan Sadık Tatlı, Ph.D., Assistant Professor, Department of Business Management, Istanbul Beykent University, Cihangir, Siraselviler Cd. No:65, 34433 Beyoğlu, Istanbul, e-mail: hasantatli@beykent.edu.tr (ORCID: <https://orcid.org/0000-0003-1918-3188>).

3 Gözde Bozkurt, Ph.D., Assistant Professor, Department of Economics, Istanbul Beykent University, Cihangir, Siraselviler Cd. No:65, 34433 Beyoğlu, Istanbul, e-mail: gozdebozkurt@beykent.edu.tr (ORCID: <https://orcid.org/0000-0003-1085-5304>).

4 Gökten Öngel, Md., Ph.D., Child Health and Diseases Department, Istanbul Education Research Hospital, Cerrahpaşa, Org. Abdurrahman Nafiz Gürman Cd. No:24, 34098 Fatih, Istanbul, e-mail: gozdebozkurt@beykent.edu.tr (ORCID: <https://orcid.org/0000-0002-4165-3601>).

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INTRODUCTION

Recently, many stakeholders, e.g., consumers, nongovernmental organizations, and public institutions, have been pressing companies to establish and implement policies on CSR (Lai et al., 2018; Duque-Grisales & Aguilera-Caracuel, 2021). Today, the widespread use of reporting processes for CSR is integrated into business strategies in line with the goals of achieving long-term competitive advantage and increasing financial performance (McGuinness et al., 2017; Amorelli & Garcia-Sanchez, 2021). ESG reporting comes to the fore in measuring companies' efforts toward CSR. The emergence of ESG reporting significantly contributed to the institutionalization of nonfinancial reporting with different aspects (Oktem & Oktem, 2022). At the Global Reporting Initiative (GRI) Conference (2008), reporting financial reporting and ESG reporting to an internationally accepted standard was determined as a strategic goal. Thus, the foundations of an integrated reporting guide, including ESG, were laid (Öztürk, 2019). Deloitte (2011) states that relationships between financial results and ESG performance are better understood when there is a direct link between ESG performance and overall strategy and business models. In addition, shareholders and other stakeholders want to know what companies see as "significant" ESG issues and what they are doing to manage them (Eccles et al., 2015). Recently, ESG issues have become an element affecting many companies' investment decisions, compensation policies, or public relations activities (Berg et al., 2021). Therefore, more companies have started to publish ESG reports to meet this need. In addition to these problems, Turkey, as a developing country, also encourages the sustainability policies of companies within the scope of sustainability. For this purpose, the sustainability index was created within Borsa Istanbul (BIST) in 2014, which is aimed at encouraging companies to operate within the scope of sustainability (Borsa Istanbul, 2020).

A research agenda on ESG criteria has also emerged in the academic field. Studies often focus on how the adoption of ESG criteria affects firm performance. For example, Xie et al. (2019) stated there is a positive relationship between ESG criteria and corporate productivity. Many researchers have similarly concluded that adopting ESG criteria positively affects firms' financial performance (Broadstock et al., 2020; Albitar et al., 2020; Wu et al., 2022). However, contradicting results indicate that the adoption of ESG criteria is not related to firm performance (Atan et al., 2018). Finally, Huang (2021) concluded that the effect of the adoption of ESG criteria on a firm's financial performance is quite modest. While there is a wide variety of other results, it is not yet clear how ESG criteria contribute to a firm's performance, given the evidence in question.

The number of studies on how the results of this information affect company performance depends on the level of development of the countries (e.g., Khemir, 2019; Gok et al., 2019; Lopes & Imoniana, 2021; Wahua & Ezeilo, 2021; Harabida et al., 2022). Limited research suggests that environmental practices may result in cost increases or hinder competition (Mao & Wang, 2019). In this context, the impacts of environmental factors on businesses should not only be limited to environmental sensitivity. However, they should also be approached from a broader perspective as part of ESG paradigms.

Understanding the impact of firms' alignment with environmental, social, and governance (ESG) criteria on their financial performance has become an increasingly focused area of research in recent years. The existing literature addresses the impact of ESG criteria on firm performance from various perspectives. However, much of this research has focused on firms in developed countries, making it difficult to consider the characteristics and dynamics of developing countries. This situation makes it imperative to examine how the alignment of ESG criteria with firm performance in developing countries affects financial performance metrics such as ROA (Return on Assets), Tobins' Q (Market Performance), and ROE (Return on Equity).

This article aims to provide a new perspective on the literature by examining how the adoption of each ESG criterion by firms in developing countries such as Turkey affects their financial performance. Taking into account the gaps in the literature, this study aims to investigate in more detail the impact of each ESG criterion on firm performance in developing countries. Therefore, considering the limited number of studies results, it becomes crucial to identify the relationships between the E, S, and G sub-dimensions and ROA, ROE, and Tobin Q in Turkey and many other developing countries. Consequently, the study results regarding the relationships between ESG and financial performance are presented below, followed by the development of hypotheses.

In the research, ESG criteria and companies' financial performance are examined. In the following parts of the research, a literature review of ESG is presented; then, research hypotheses are formed. Afterward, the method and findings of the study are presented. Finally, the research results and the discussion of the results were carried out.

THEORETICAL FRAMEWORK AND RELATIONS BETWEEN CONCEPTS

ESG criteria and Financial performance

ESG focuses on three main issues, i.e., environmental sub-dimension that examines how a business should perform as a protector of the natural environment (e.g., waste and pollution, resource depletion, greenhouse gas emissions, deforestation, climate change, etc.); social sub-dimension that examine how a company treats people (e.g., employee relations and diversity; child labor and slavery; working conditions and local communities, thus openly funding projects or institutions that serve poor and underserved communities globally; health and safety; conflict); and, finally, governance sub-dimension that examine how the company controls itself (i.e., how the company is run, e.g., tax strategy, executive salary, donations and political lobbying, corruption and bribery, board diversity and structure). Making the necessary transformations in the enterprise's policies, strategies, and operational cycles within the framework of the three sub-dimensions can directly affect an enterprise's ability to create long-term value. For this reason, transparency and success in managing ESG processes are positively rewarded by investors (Kızıltan & Doğan, 2021). These rewards can shape company strategies. ESG criteria affect investment decisions, compensation policies, or financial and nonfinancial activities such as public relations for many companies (Berg et al., 2021).

Financial performance measures a firm's success in earning profits. ROA ratio is used as a reference to evaluate a firm's success in financial activities. Many studies show that the ROA ratio positively and significantly affects a firm's value (Luthfiah & Suherman, 2018; Rosikah et al., 2018; Sudiyatno et al., 2020; Li & Wan, 2021). ROE measures a company's profitability on its capital and is mainly used to compare its profitability with other companies in the same industry. The ROE ratio is one of the popular ratios used to measure a firm's management performance for investors (Atan et al., 2018). ROA and ROE accounting-based metrics are typically lagging indicators, while market-based indicators such as Tobin's Q are leading indicators. Tobin's Q is a key indicator of profitability. This ratio indicates whether an asset is overvalued or undervalued and is a long-term measure of the company's value (Atan et al., 2018; Rodríguez-Fernández et al., 2019).

Theoretical background

As a trend in recent years, the purpose of companies has been extended not only to the interests of shareholders directly but also to employees, society, customers, society and all other related environments (Grove et al., 2020). While studies based on stakeholder theory have mostly had a company performance-focused perspective until recently, they have recently begun to be associated with issues such as responsibility and value creation (Signori et al., 2021). Stakeholder theory provides a convincing basis for ESG criteria as it offers a good perspective in explaining companies' relationships with their socio-economic stakeholders. ESG criteria, which prioritize responsibility towards the environment, governance and social stakeholders, are deeply related to stakeholder theory (Li et al., 2021; Fu et al., 2022; Wai-Khuen et al., 2023), so much so that combining a broader stakeholder awareness with social responsibility makes it easier for the company to adopt ESG criteria (Hu et al., 2023).

Stakeholder theory forms the basis of ESG research, as it includes internal stakeholders and society, government, customers, suppliers, and competitors. Stakeholder theory states that the long-term success of companies is possible by meeting the needs of internal and external stakeholders (Freeman, 1984). According to the social impact hypothesis, based on the stakeholder theory (Freeman, 1984), companies operating for the benefit of stakeholders positively affect the corporate reputation and financial performance (Robbins & Coulter, 2002). On the other hand, the opposite situation is the realization of negative financial impact as a result of the disappointment of these stakeholders (Preston & O'Bannon, 1997). According to the positive synergy hypothesis, there is a sequential relationship between a firm's social responsibility and its profitability (Friedman, 1970). The hypothesis assumes that companies with high corporate social performance will have the opportunity to reinvest in social responsibility actions, leading to performance improvement (Allouche & Laroche, 2005). Therefore, creating a productive cycle will result in a concurrent positive relationship between CSR and financial performance (Waddock & Graves, 1997).

In the negative synergy hypothesis, it is argued that firms' high CSR performance leads to low financial performance. It is stated that this situation will cause companies to limit their social responsibility investments (Makni et al., 2009). Based on the hypothesis, Brammer, Brooks, and Pavelin (2006) suggested that there is a vicious circle between social responsibility and financial performance and that there may be a simultaneous negative relationship. Similar to the negative synergy hypothesis in the literature, there is a balancing hypothesis, which assumes that CSR has a negative

effect on financial performance. The balancing hypothesis supports Friedman's argument; it is further argued that social responsibility behavior will provide few economic benefits. Still, the numerous costs will also reduce the firms' profits and stakeholders' wealth (Waddock & Graves, 1997). According to the positive and negative synergy hypotheses, neither party is decisive in the relationship between financial performance and corporate social performance. Financial performance and corporate social performance can affect each other mutually and simultaneously (Düzer, 2018).

Relationships between concepts

Many factors must be considered to understand the relationship between ESG and financial performance (Nirino et al., 2021). Indeed, a firm's ESG score reflects the sum of its sub-dimensions. The effect of each sub-dimension on firm performance may differ (Duque-Grisales & Aguilera-Caracuel, 2021). While some studies state that the ESG score can be used alone, others argue that every dimension of the ESG should be used for various reasons, such as sociocultural conditions and stakeholders' expectations (Duque-Grisales & Aguilera-Caracuel, 2021; Limkriangkrai et al., 2017; Humphrey et al., 2012). Especially in developing economies, companies' top management experience problems adapting to international market conditions due to religion, culture, and social characteristics (Raynar & Fosrtater, 2002). At the same time, CSR activities in developing economies have a lower maturity level than in developed ones (Garcia et al., 2017). In these countries, ESG investments also remain at a low level (Blowfield & Frynas, 2015), reports are published in a limited manner (Serafeim, 2014), and markets are not monitored effectively (Orsato et al., 2015).

Some of the limited studies examining the alignment of firms with ESG criteria in developing countries present positive views. A study by Sherwood and Pollard (2018) found that firms aligning with ESG criteria in developing markets pose less risk to investors and generate higher returns. On the other hand, Martins (2022) suggested that market structure in a developing country may also be related to firms' alignment with ESG criteria, with competitive shocks in the market reducing firms' intentions to align with ESG criteria. At this point, Turkey is taking significant steps towards fulfilling its international commitments regarding climate, sustainability, and the European Union's (EU) policy goals within the framework of sustainability goals and ESG criteria. In line with this objective, Turkey has implemented the EU Taxonomy Regulation to achieve the 2030 climate and energy goals outlined in the European Green Deal and to ensure that investments are directed towards sustainable projects and activities. Additionally, Turkey is undertaking various activities within its legal framework in line with its sustainability goals and ESG criteria (Ministry of Trade, 2024).

Despite these developments, studies need to examine the impact of firms' alignment with ESG criteria on their financial performance in Turkey. In a study conducted by Saygılı et al. (2022), which focused on firms listed on the Borsa Istanbul, the effect of ESG criteria on corporate financial performance was investigated. According to the research findings, the environmental sub-dimension was found to have a negative impact on firms' corporate financial performance. At the same time, stakeholder engagement contributed to operational efficiency in the social dimension of CSR. Additionally, the study found that provisions related to ownership rights and the board of directors positively influence corporate financial performance in the governance dimension.

A study by Özer et al. (2023) examined the relationship between ESG scores and firms' financial performance for firms listed on the Borsa Istanbul between 2009 and 2019. The study found a positive relationship between these variables. Additionally, the study addressed the sub-dimensions of ESG, where the environmental dimension was positively associated with firms' financial performance. In contrast, the social and governance dimensions were not statistically related to financial performance.

On the other hand, a study by Özdarak and Akarcay (2022) investigated the relationship between ESG disclosures and the financial performance of firms listed on the Borsa Istanbul Metal Products Machinery Index between 2009 and 2018. The findings of the research indicate that there was no statistically significant relationship between ESG disclosures and financial performance. Therefore, considering the limited number of studies, it becomes crucial to identify the relationships between E, S, and G sub-dimensions and ROA, ROE, and Tobin Q in Turkey and many other developing countries. Consequently, the study results regarding the relationships between ESG and financial performance are presented below, followed by the development of hypotheses.

Some of the rare studies examining the adoption of ESG criteria with the performance of firms in developing countries offer positive opinions. Sherwood and Polard (2018) concluded that companies that comply with ESG criteria in emerging markets cause less risk for investors and provide higher returns. Martins (2022), on the other hand, stated that the market structure in a developing country may also be related to the adoption of the companies with the ESG criteria and determined that the competition shocks in the market reduce the intention of companies to comply with the ESG criteria

(Martins, 2022). Considering the results of rare studies, it becomes important to determine the relationships among E, S, and G sub-dimensions and ROA, ROE, and Tobin's Q in developing countries (in the case of Turkey). For this reason, the study's results, in which the relationships between ESG and financial performance are determined, are presented below, and hypotheses are developed.

ESG and firm's ROA: Buallay et al. (2021) found a positive relationship between the ESG criteria (E, S, G) and firms' financial performance. Further, Nirino et al. (2021) concluded that the governance sub-dimension negatively affects firms' financial performance. Velte (2017) supposed that there is a positive relationship between the ESG criteria and the financial performance of the firms. On the other hand, Buallay (2019) concluded that the environment and governance sub-dimensions positively affect the firm's financial performance. However, Alareeni and Hamdan (2020) determined that the environmental sub-dimension is negatively related to a firm's financial performance. Based on these results, the following hypotheses were formed:

- H_1 : ESG criteria positively affect firms' ROA.
- H_{1a} : The environmental sub-dimension positively affects firms' ROA.
- H_{1b} : The social sub-dimension positively affects firms' ROA.
- H_{1c} : The governance sub-dimension positively affects firms' ROA.

ESG and firm's ROE: The expectation, based on stakeholder theory, is that firms' CSR/ESG reporting will increase firms' financial performance (Albitar et al., 2020). In addition to these views, the results of empirical studies contain contradictions. Buallay et al. (2021) found a positive relationship between the ESG criteria and the firms' financial performance. Further, Nirino et al. (2021) concluded that the governance sub-dimension negatively affects a firm's financial performance. On the other hand, Atan (2018) found no relationship between ESG criteria and financial performance in developing countries. Friede et al. (2015) and Hang et al. (2018) stated that each of the sub-dimensions that make up the ESG score has a different relationship and effect on financial performance. Therefore, we put forward the following hypotheses:

- H_2 : ESG criteria positively affect firms' ROE.
- H_{2a} : The environmental sub-dimension positively affects firms' ROE.
- H_{2b} : The social sub-dimension positively affects firms' ROE.
- H_{2c} : The governance sub-dimension positively affects firms' ROE.

ESG and firm's Tobin's Q: Buallay et al. (2021) found a negative relationship between the ESG criteria and the firms' market performance. Further, Nirino et al. (2021) concluded that the governance sub-dimension negatively affects the firms' market performance. On the other hand, Atan (2018) found no relationship between ESG criteria and financial performance in developing countries. Gregory (2022) determined there is a positive relationship between ESG criteria and market performance. Velte (2017) found no significant relationship between the ESG criteria and firms' market performance. Alareeni and Hamdan (2020) revealed a negative relationship between environmental sub-dimension and market performance. Finally, it has been determined that the firm's market performance is affected positively by the environmental sub-dimension, negatively by the social sub-dimension, and positively by the governance sub-dimension (Buallay, 2019). Therefore, we put forward the following hypotheses:

- H_3 : ESG criteria positively affect firms' Tobin's Q.
- H_{3a} : The environment sub-dimension positively affects firms' Tobin's Q.
- H_{3b} : The social sub-dimension positively affects firms' Tobin's Q.
- H_{3c} : The governance sub-dimension positively affects firms' Tobin's Q.

RESEARCH METHODS

In this section, the data to be analyzed are introduced, and brief econometric information about the tests and methods used is given.

Data collection and sample selection

The study is structured as a panel dataset covering the years 2011-2020 and consisting of 21 companies listed in the BIST 100 index. Data analysis was conducted at an annual frequency, and the ESG data for the selected period were available for the sample firms. The variables used to create the dataset were obtained from the Thomson Reuters Eikon database.

The selection of the 21 companies from the BIST 100 index was based on the availability and completeness of the ESG data in the Thomson Reuters Eikon database for the entire study period. Companies that did not have consistent ESG data for the 2011-2020 period were excluded from the sample to ensure the reliability of the analysis. This selection sub-dimensions helps mitigate any potential bias arising from incomplete data and enhances the robustness of the findings. In the study, attention was paid to tests that can be used even in very small sample size situations. The ESG scores were updated continuously by Thomson Reuters, which aggregates data from various sources such as company reports, news articles, and public disclosures. For this study, we used the ESG scores as of December 31st of each year, ensuring that they reflect the information available up to the end of that year. This means that the ESG scores for a given year (e.g., 2019) are used to predict financial performance in the following year (e.g., 2020). This temporal alignment ensures that the ESG data precede the financial performance data, allowing us to analyze the potential impact of ESG performance on subsequent financial performance.

Research variables

Dependent variables

Financial performance serves as a measure of a company's success in earning profit. To evaluate a firm's success in its financial activities, reference is frequently made to indicators such as ROA, ROE, and Tobin's Q ratios (Chadha & Sharma, 2015; Luthfiah & Suherman, 2018; Rosikah et al., 2018; Bennouri et al., 2018; Almoneef & Samontaray, 2019; Sudiyatno et al., 2020; Li & Wan, 2021). The efficiency of a firm's operations significantly influences its financial performance. In other words, performance analysis indicates how effectively and efficiently a firm can utilize its resources towards achieving its set objectives (Yakut et al., 2015). In this context, ROA, ROE, and Tobin's Q ratios were selected as the study's dependent variables. The financial performance metrics (ROA, ROE, and Tobin's Q) were obtained from the Thomson Reuters Eikon database. These metrics are derived from the companies' annual reports, which are compiled and made available through the Eikon database. For example, the financial data for the year 2020 were sourced from the Eikon database, which includes information from annual reports published in early 2021, thus reflecting the performance of the company for the entire year 2020. Tobin's Q ratio was calculated using the following formula based on the Bloomberg database:

$$\text{Tobin's Q} = \frac{(\text{Market Capitalization} + \text{Total Liabilities} + \text{Preferred Equity} + \text{Minority Interest})}{\text{Total Assets}}$$

Independent variables

This study uses ESG scores from the Eikon Thomson Reuters datastream database as independent variables. The effects of the three subcomponents (E, S, G) that make up the ESG score were analyzed separately. Scores range from 0 to 100 points: 0–25 = poor; 25–50 = moderate; 50–75 = good; 75–100 = excellent ESG performance. The E, S, and G criteria include (Refinitiv, 2020):

E Score

The environmental pillar measures a company's impact on living and nonliving natural systems, including the air, land, and water, as well as complete ecosystems. It reflects how well a company uses best management practices to avoid environmental risks and capitalize on environmental opportunities to generate long-term shareholder value.

S Score

The social pillar measures a company's capacity to generate trust and loyalty with its workforce, customers, and society through best management practices. It reflects a company's reputation and the health of its operating license, which are key factors in determining its ability to generate long-term shareholder value.

G Score

The corporate governance pillar measures a company's systems and processes, which ensure that its board members and executives act in the best interest of its long-term shareholders. It reflects a company's capacity, through its use of best management practices, to direct and control its rights and responsibilities through the creation of incentives and checks and balances to generate long-term shareholder value. In addition, in accordance with the existing literature, frequently used in measuring financial performance, variables of total assets, total asset turnover, firm growth rate (annual change in total assets), leverage (total debt/total capital), net sales/revenues (annual change), market-to-book value, and firm age are included in the analysis (Tang et al., 2012; Rodríguez-Fernández et al., 2019; Koroleva et al., 2020; Alareeni & Hamdan, 2020; Atan et al., 2018; Dasgupta, 2022; Duque-Grisales & Aguilera-Caracuel, 2021; Bellamy et al., 2014; Kortmann et al., 2014; Lam et al., 2019; Utami & Hasan, 2021; Hasan et al., 2020).

Control variables

The firm's value is closely associated with its capital structure, profitability, and size. Firm size is typically assessed through various metrics such as assets, total sales, profit, and tax burden (Elouidani & Zoubir, 2015; Mule et al., 2015; Gunawan et al., 2018; Meizari & Viani, 2017; Murdayanti et al., 2020; Sudiyatno et al., 2020; Akgül, 2020). The number of assets owned by a firm often serves as an indicator of its size, with higher asset quantities implying a larger firm size. Furthermore, the literature extensively explores the relationship between financial performance and operational efficiency, utilizing variables like financial leverage, profitability ratios, firm age, size, and operating income (Bellamy et al., 2014; Kortmann et al., 2014; Lam et al., 2019; Utami & Hasan, 2021; Hasan et al., 2020). Hence, the selection of control variables for this study aligns with the findings of previous research. As such, the control variables used in this study include the total asset turnover rate, company growth rate, leverage, total assets, sales growth rate, price/book ratio, and company age.

These control variables were selected based on their relevance and frequent usage in the literature on financial performance (Tang et al., 2012; Rodríguez-Fernández et al., 2019; Koroleva et al., 2020; Alareeni & Hamdan, 2020; Atan et al., 2018; Dasgupta, 2022; Duque-Grisales & Aguilera-Caracuel, 2021; Bellamy et al., 2014; Kortmann et al., 2014; Lam et al., 2019; Utami & Hasan, 2021; Hasan et al., 2020). Including these control variables helps isolate the specific impact of ESG performance on financial outcomes by accounting for other factors that could affect financial performance.

Analytic methods

This study has utilized longitudinal data. Panel random effects (PRE) regression has been used after applying Hausman's test. Also, a Parks–Kmenta and Huber–Eicker–White regression was run to test the endogeneity and robustness of results. The fact that all units are affected at the same level against the shock that occurs in any of the units, that is, the independence of the units from each other, was examined with the Pesaran (2004) CD test. The Pesaran test, which is an improvement of the Breusch and Pagan (1980) test, is based on the sum of the correlation coefficients between the cross-section residues:

$$CD = \sqrt{\frac{2T}{N(N-1)}} \sum_{i=1}^{N-1} \sum_{j=i+1}^N \hat{\rho}_{ij} \quad (N > T) \quad (1)$$

This test statistic shows a standard normal distribution (Pesaran, 2004), under the hypothesis, which shows that there is no relationship between the cross sections. In case the basic hypothesis is not rejected as a result of the test, first-generation unit root tests were used (Breitung, 2000; Im et al., 2003; Hadri, 2000; Levin et al., 2002); in the case of rejection, second-generation unit root tests were used, taking into account the cross-section dependency (Pesaran, 2007; Hadri & Kurozumi, 2012; Bai & Ng, 2004). This study used the Levin–Lin–Chue (2002) test from the first-generation unit

root tests and Pesaran (2007) test from the second-generation unit root tests. The test developed by Pesaran (2007) can be used for differences in panel time and unit dimensions for ($T > N$ ve $N > T$):

$$\Delta y_{it} = \alpha_i + b_i y_{i,t-1} + \gamma_i f_t + e_{it} \quad (2)$$

In Equation 2, the error term is expressed as $e_{it} = \lambda_i f_t + u_{it}$. In the equation of the error term, f_t ; It is considered as an invisible common effect and is assumed to be stationary. “ u_{it} ” indicates the individual error of the companies. The cross-sectional dependence in the model arises from the invisible common effect. Also, in the study, attention was paid to tests that can be used even in very small sample size situations. If the CIPS statistic is calculated according to the CADF unit root test equation, and the $CIPS = \frac{1}{N} \sum_{i=1}^N CADF_i$ basic hypothesis ($H_0: b_i = 0, H_a: b_i < 0$) is rejected, it is seen that the studied series is stationary (Pesaran, 2007: 269–271). In the test developed by Levin–Lin–Chu (2002), estimation of is made through the variables Δy_{it} and y_{it} , which are free of autocorrelation and deterministic features:

$$\Delta y_{it} = \alpha y_{it-1} + \sum_{j=1}^{p_i} b_{ij} \Delta y_{it-j} + X'_{it} \delta + e_{it} \quad (3)$$

In Equation 3, $X'_{it} \delta$ refers to the deterministic variables “ $\alpha_{mi} d_{mt}$ ” (constant term, trend, etc.) and their coefficients. If the basic hypothesis ($H_0: \alpha = 0$) is rejected, it is concluded that the studied series is stationary ($H_a: \alpha < 0$). Panel regression equations were created after determining whether the series has unit roots and ensuring their stationarity with the necessary transformations.

ESG and firm efficiency models

The study uses panel regression analysis to examine the relationship between the sub-dimensions a that make up the ESG and firm performance. The following models are estimated to achieve the research objectives.

Model 1:

$$TobinQ_{it} = \alpha_0 + \beta_1 E_{it} + \beta_2 S_{it} + \beta_3 G_{it} + \beta_4 TotalAssetTurnoverRate_{it} + \beta_5 CompanyGrowthRate_{it} + \beta_6 Lever_{it} + \beta_7 TotalAssests_{it} + \beta_8 SalesGrowthRate_{it} + \beta_9 pd/dd_{it} + \beta_{10} CompanyAge_{it} + \varepsilon_{1it} \quad (4)$$

Model 2:

$$ROAQ_{it} = \alpha_0 + \beta_1 E_{it} + \beta_2 S_{it} + \beta_3 G_{it} + \beta_4 TotalAssetTurnoverRate_{it} + \beta_5 CompanyGrowthRate_{it} + \beta_6 Lever_{it} + \beta_7 TotalAssests_{it} + \beta_8 SalesGrowthRate_{it} + \beta_9 pd/dd_{it} + \beta_{10} CompanyAge_{it} + \varepsilon_{1it} \quad (5)$$

Model 3:

$$ROE_{it} = \alpha_0 + \beta_1 E_{it} + \beta_2 S_{it} + \beta_3 G_{it} + \beta_4 TotalAssetTurnoverRate_{it} + \beta_5 CompanyGrowthRate_{it} + \beta_6 Lever_{it} + \beta_7 TotalAssests_{it} + \beta_8 SalesGrowthRate_{it} + \beta_9 pd/dd_{it} + \beta_{10} CompanyAge_{it} + \varepsilon_{1it} \quad (6)$$

where α_0 is a constant term, β_k $k=1$ to 10 are the coefficients of the respective independent/control variables, i =company, t =year, and ε_{1it} is an error term. In cases of varying variance, autocorrelation, and inter-unit correlation, the variance covariance matrix (Ω) of the error term is not equal to the unit matrix.

In this case, ($Cov(\varepsilon_{it}\varepsilon_{it}) = \sigma_\varepsilon^2 Z_T$); further, in the presence of at least one heteroscedasticity, autocorrelation, and inter-unit correlation, the estimates are inconsistent but efficient. In this case, the standard errors should be corrected without touching the parameter estimates (obtainable standard errors with resistance); if they exist, estimation should be made with appropriate methods. **Model 1** and **Model 2** are solved with the Parks–Kmenta estimator with the generalized least-squares method, which needs fewer restrictions than the least-squares method. In this approach, the model examined first is estimated by the OLS method; then, the residues obtained are used to calculate autocorrelation and heteroscedasticity, again by the GLS method. This process continues until β_k 's approach a fixed number (Kmenta, 1986). **Model 3** was estimated with the Huber–Eicker–White estimator, also called the White estimator, for the variable variance problem only. The estimator introduced by Huber (1967), Eicker (1967), and White (1980) is used under the assumption that the Ω matrix is known and diagonal, but the diagonal elements are not equal to each other when there is only varying variance in the model, that is, if the residues are independently distributed (Astivia & Zumbo: 2019).

RESULTS

This section introduces the data to be analyzed, stability tests are performed, brief information is given about the tests and methods, and panel regression analyses evaluate the findings.

Statistical analysis

Summary statistics of the sample covering the years 2011–2021 of 20 companies are given in Table 1. The natural logarithm of the variables was taken to ensure stationarity in variance.

Table 1. Descriptive statistics

Statistics	Shortening	Number of observations	Average value	Standard deviation	Minimum	Maximum
Variables						
<i>ln(Environment)</i>	<i>ln(env)</i>	210	3.9589	0.5232	1.5368	4.5792
<i>ln(Social)</i>	<i>ln(soc)</i>	210	3.9846	0.4834	2.3369	4.5735
<i>ln(Governance)</i>	<i>ln(gov)</i>	210	3.8223	0.5197	1.5581	4.5038
<i>ln(TobinQ)</i>	<i>ln(tQ)</i>	210	0.1799	0.3113	-0.2613	1.4562
<i>ln(Roa)</i>	<i>ln(roa)</i>	210	4.1754	0.1022	3.9518	4.7563
<i>ln(Roe)</i>	<i>ln(roe)</i>	210	4.4790	0.1449	3.8037	4.9649
<i>ln(Total Asset Turnover Rate)</i>	<i>ln(tatr)</i>	210	17.609	1.5383	13.867	20.387
<i>ln(Company Growth Rate)</i>	<i>ln(cgr)</i>	210	5.8472	0.0618	5.7526	6.4777
<i>ln(Leverage)</i>	<i>ln(lev)</i>	210	3.6974	1.2243	-2.3025	4.4266
<i>ln(Total Assets)</i>	<i>ln(ta)</i>	210	-1.0191	1.1358	-3.2188	1.0331
<i>ln(Sales Growth Rate)</i>	<i>ln(sgr)</i>	210	4.8667	0.1385	4.1612	5.4194
<i>ln(price/book)</i>	<i>ln(pd)</i>	210	0.2782	0.6627	-1.5606	1.7387
<i>Company Age</i>	<i>ca</i>	210	53.2619	21.964	14	96

The fact that some variables (for example, *ln(roa)* and *ln(cgr)*) have low standard deviations may indicate that these variables are more stable over time. The wide distribution observed in the *ln(lev)* and *ln(pd)* variables suggests differences in the companies' financial structures and market valuations. High average values of performance and growth metrics such as *ln(ta)*, *ln(cgr)*, and *ln(sgr)* indicate that companies are generally growth-oriented and have high active usage. Table 2 shows the correlation matrix that expresses the relationship and direction of the variables as *a priori*.

Table 2. Correlation matrix

	<i>ln(env)</i>	<i>ln(soc)</i>	<i>ln(gov)</i>	<i>ln(tQ)</i>	<i>ln(roa)</i>	<i>ln(roe)</i>	<i>ln(tatr)</i>	<i>ln(cgr)</i>	<i>ln(lev)</i>	<i>ln(ta)</i>	<i>ln(sgr)</i>	<i>ln(pd)</i>	<i>ln(ca)</i>
<i>ln(env)</i>	1.000												
<i>ln(soc)</i>	0.626	1.000											
<i>ln(gov)</i>	0.380	0.383	1.000										
<i>ln(tQ)</i>	-0.012	-0.262	-0.018	1.000									
<i>ln(roa)</i>	-0.146	-0.415	-0.047	0.681	1.000								
<i>ln(roe)</i>	0.031	-0.171	-0.057	0.555	0.723	1.000							
<i>ln(tatr)</i>	0.292	0.543	-0.070	-0.661	-0.628	-0.311	1.000						
<i>ln(cgr)</i>	0.013	0.081	-0.062	0.083	0.256	0.390	-0.027	1.000					
<i>ln(lev)</i>	0.334	0.523	0.254	-0.288	-0.644	-0.211	0.493	-0.036	1.000				
<i>ln(ta)</i>	-0.068	-0.175	0.245	0.569	0.493	0.308	-0.760	0.063	-0.148	1.000			
<i>ln(sgr)</i>	0.037	0.061	-0.006	0.030	0.165	0.147	0.035	0.260	-0.070	-0.004	1.000		
<i>ln(pd)</i>	-0.017	-0.301	0.043	0.806	0.499	0.383	-0.696	0.014	-0.146	0.618	-0.070	1.000	
<i>ca</i>	0.150	0.272	-0.052	-0.575	-0.407	-0.165	0.611	0.064	0.319	-0.421	0.045	-0.633	1.000

It has been determined that the relations between the variables differ according to the correlation matrix findings and coefficient signs. While the highest positive relationship is between ROA and ROE, it is seen that the lowest positive relationship is between the environment and firm growth rate. The highest negative relationship is between total assets and total asset turnover, and the lowest relationship is between total assets and sales growth rate.

Before determining the stationarity of the series, it is necessary to examine the cross-section dependence. If there is a correlation between the sections, unit root tests that take this dependency structure into account should be used. The cross-sectional dependence of the series was examined; the results are given in Table 3.

Table 3. Cross-sectional dependence

Variables	CD-test	p-value	Correlation	Absolute correlation	Decision: No cross-sectional dependence
<i>ln(env)</i>	14.87	0.000	0.32	0.51	rejected
<i>ln(soc)</i>	21.786	0.000	0.48	0.57	rejected
<i>ln(gov)</i>	0.909	0.363	0.02	0.31	not rejected
<i>ln(tQ)</i>	17.232	0.000	0.38	0.46	rejected
<i>ln(roe)</i>	1.288	0.198	0.03	0.35	not rejected
<i>ln(roe)</i>	2.141	0.032	0.05	0.34	rejected
<i>ln(tatr)</i>	13.337	0.000	0.29	0.40	rejected
<i>ln(cgr)</i>	7.871	0.000	0.17	0.31	rejected
<i>ln(lev)</i>	0.973	0.330	0.02	0.43	not rejected
<i>ln(ta)</i>	43.204	0.000	0.94	0.94	rejected
<i>ln(sgr)</i>	12.129	0.000	0.26	0.37	rejected
<i>ln(pd)</i>	10.212	0.000	0.22	0.47	rejected
Number of Sections	21	21	21	21	

Note: Horizontal sections are independent of each other. $CD \sim N(0,1)$.

According to the results obtained from the Pesaran (2004) cross-section dependency test, the main hypothesis could not be rejected in the variables of governance, ROA, and leverage. In other variables, as a result of the rejection of the basic hypothesis, it was determined that there was a correlation between the sections (firms) that make up the data set, that is, a cross-section dependency. The variable with the highest correlation level was calculated as total assets, and the variable with the lowest level was calculated as ROE. Pesaran's (2003) CADF test, which is one of the second-generation unit root analyses that can be used in the presence of this problem, was applied for the series with cross-section dependence. However, beforehand, the multicollinearity problem among the independent variables was tested using the VIF (Variance Inflation Factor) criterion.

Table 4. Multiple linear correlation

Variables	VIF	1/VIF
<i>ln(ta)</i>	3.48	0.287356
<i>ln(tatr)</i>	3.24	0.308828
<i>ln(soc)</i>	2.77	0.360702
<i>ln(pd)</i>	2.28	0.437825
<i>ln(env)</i>	1.89	0.529817
<i>ln(gov)</i>	1.51	0.663391
<i>ln(lev)</i>	1.30	0.767764
<i>ln(cgr)</i>	1.11	0.898650
<i>ln(sgr)</i>	1.05	0.956027
Mean VIF	2.07	

Table 4 shows that the average value of the VIF criterion is 2.07. Since it is less than 5, it can be said that there is no multicollinearity between the variables. It supports that there is no multicollinearity in the results based on variables.

In addition, the coefficients in the correlation matrix given in Table 3 support that there is no multicollinearity problem between the study's variables. For series where cross-sectional dependence was not detected, the Levin-Lin and Chu (2002) test, one of the first generation unit root tests, was applied. The results are given in Table 5.

Table 5. Unit root tests

Variables	Constant Term + Trend (Second Generation)			Constant Term + Trend (First Generation)		Decision: H_0 : There is a unit root	Result
	<i>t</i> -bar	<i>Z</i> -bar	<i>p</i> -value	<i>t</i> -statistic	<i>p</i> -value		
<i>ln(gov)</i>				-8.372	0.000	H_0 rejected	$I(0)$
<i>ln(roe)</i>				-8.565	0.000	H_0 rejected	$I(0)$
<i>ln(lev)</i>				-9.337	0.000	H_0 rejected	$I(0)$
<i>ln(tQ)</i>	-2.843	-1.749	0.040			H_0 rejected	$I(0)$
<i>ln(sgr)</i>	-3.820	-4.584	0.000			H_0 rejected	$I(0)$
<i>ln(tatr)</i>	-3.046	-2.337	0.010			H_0 rejected	$I(0)$
<i>ln(env)</i>	-2.161	-1.610	0.054			H_0 not rejected	
$\Delta \ln(env)$	-3.246	-5.320	0.000			H_0 rejected	$I(0)$
<i>ln(soc)</i>	-2.621	-1.106	0.134			H_0 not rejected	
$\Delta \ln(soc)$	-2.593	-3.089	0.001			H_0 rejected	$I(0)$
<i>ln(roe)</i>	-1.825	-0.463	0.322			H_0 not rejected	
$\Delta \ln(roe)$	-2.245	-1.889	0.029			H_0 rejected	$I(0)$
<i>ln(cgr)</i>	-2.377	-0.398	0.345			H_0 not rejected	
$\Delta \ln(cgr)$	-2.438	-2.559	0.005			H_0 rejected	$I(0)$
<i>ln(ta)</i>	-2.209	0.091	0.536			H_0 not rejected	
$\Delta \ln(ta)$	-2.270	-1.985	0.024			H_0 rejected	$I(0)$
<i>ln(pd)</i>	-1.656	0.118	0.547			H_0 not rejected	
$\Delta \ln(pd)$	-2.520	-2.839	0.002			H_0 rejected	$I(0)$

Note: When the time path graphs of the companies are examined; They were added because it was determined that they showed a certain average and a trend over time.

In line with the findings obtained from the stationarity analysis, it was determined that governance, ROA, leverage, Tobin's Q, sales growth rate, and total asset turnover series do not contain unit roots. As a result of the rejection of the basic hypothesis in the related series, it was concluded that they were stationary at the 5% significance level with their level states. However, as seen in the table, there is no stationarity in the levels of other variables. For this reason, it was determined that the series became stationary when the first differences were taken and retested for the same significance level. In the next phase of the analysis, the variables were studied in their stationary states. A non-stationary (with unit root) series violates econometric assumptions and causes the model to produce biased and inconsistent estimates. F-test, Breusch–Pagan, and Hausman tests were applied to determine the correct model for the series selection with determined stationarity and the panel data models. The results are given in Table 6.

Table 6. Model selection

Test	Model 1 (Dependent Variable, Tobin's Q)	Model 2 (Dependent Variable, ROA)	Model 3 (Dependent Variable, ROE)
<i>F</i>	11.44 (0.000)	7.03 (0.000)	5.76 (0.000)
LM (Breusch- Pagan)	178.39 (0.0000)	92.99 (0.000)	56.10 (0.000)
Hausman	10.76 (0.4683)	5.60 (0.8989)	12.65 (0.1791)

Note: The values in parentheses show the *p*-probability values of the relevant test statistic.

Table 6 shows the model selection tests of three different model estimations, where the dependent variable, Tobin's Q, ROA, and ROE are given collectively. The *F*-test was applied to test the classical model against the fixed effects model. The H_0 hypothesis that the unit and time effect is equal to zero is rejected. In this case, it is concluded that there are fixed effects, and the classical model cannot be applied. As a result of the Breusch–Pagan LM test applied to test the suitability of the classical model against the random effects model, the H_0 hypothesis is rejected. It was concluded that the classical model is not suitable because the variance of the unit effects is nonzero. According to the Hausman test result, since the H_0 hypothesis was not rejected, it was decided for each internal model that the random effects estimator was valid because

it was effective. However, since the basic assumptions of this approach should be examined in the analyses based on the established linear least-squares models, the results are given in Table 7.

Table 7. Assumption tests

Test	Model 1 (Dependent Variable, Tobin's Q)	Model 2 (Dependent Variable, ROA)	Model 3 (Dependent Variable, ROE)
Levene-Brown and Forsythe	W0 = 4.1885 (0.0000) W50 = 3.0788 (0.0000) W10 = 4.1885 (0.0000)	W0 = 3.2420 (0.0000) W50 = 2.6867 (0.0003) W10 = 3.2421 (0.0000)	W0 = 5.1988 (0.0000) W50 = 1.8915 (0.0158) W10 = 5.1988 (0.0000)
Baltagi Wu LBI	DW: 1.1824 LBI: 1.5971	DW: 1.2591 LBI: 1.6254	DW = 1.7809 LBI = 2.0362
Friedman	13.455 (0.5862)	15.213 (0.7641)	16.914 (0.6585)

The cross-section dependency in the research models was examined using the Friedman R (1937) test, since the panel size of the study was $T < N$. As a result of the test, it was determined that the H_0 hypothesis could not be rejected and that the models had no cross-sectional dependence. In testing the autocorrelation assumption in the research model, Bhargava, Franzini, and Nerendranathan's Durbin-Watson and Baltagi-Wu's local best invariant tests were applied. According to the autocorrelation test results, it was determined that there was no autocorrelation problem, as the H_0 hypothesis could not be rejected in Model 3 alone. It was concluded that the statistical values in Model 1 and Model 2 were less than 2, so there was no autocorrelation problem in the random effects model. Levene, Brown, and Forsythe's test was used to test the constant variance assumption in random effects models. When the test statistics are examined, it is seen that the H_0 hypothesis, which was established as "the variances of the units are equal," was also rejected for all models. According to the results obtained, Model 1 and Model 2 have autocorrelation and varying variance problems, while Model 3 has only varying variance problems. In this case, estimation will be performed using the Parks-Kmenta estimator, which produces standard errors resistant to autocorrelation and varying variance problems for Model 1 and Model 2. The results obtained by using the Huber-Eicker-White Estimator, which is also called the White estimator because of the standard errors for Model 3 and the problem of only changing variance in the model, are given in Table 8 by making consistent efficient and unbiased coefficient estimations.

Table 8. Model estimators results

Variable	Model 1 (Parks-Kmenta) (Dependent Variable, Tobin's Q)		Model 2 (Parks-Kmenta) (Dependent Variable, ROA)		Model 3 (Huber, Eicker, and White) (Dependent Variable, ROE)	
	Coefficient	Robust Std. Err.	Coefficient	Robust Std. Err.	Coefficient	$P > z $
$\Delta \ln(env)$	0.0701998	0.034			0.08015	0.005
$\Delta \ln(soc)$						
$\ln(gov)$	-0.0793527	0.030			0.0194557	0.036
$\ln(tQ)$						
$\ln(roa)$						
$\Delta \ln(roe)$						
$\ln(tatr)$	0.1404593	0.036	0.0421742	0.008		
$\Delta \ln(cgr)$						
$\ln(lev)$			-0.0338324	0.002		
$\Delta \ln(ta)$						
$\ln(sgr)$			0.1700452	0.042	0.046105	0.000
$\Delta \ln(pd)$						
<i>ca</i>	-0.0063535	0.001				
<i>_cons</i>	0.96002424	0.141	3.515938	0.209	-2.331548	0.000
<i>Num. of obs.</i>	189		189		189	
R^2	0.4884		0.5912		0.2529	
<i>Wald Test</i>	0.0000		0.0000		0.0000	

Note: $P > |z|$ values were evaluated according to the 5% significance level, and only statistically significant variables were given.

According to the analysis results in Table 8, the variables given in the models were statistically significant at the 5% level. Statistically insignificant variables can negatively affect the prediction accuracy of the model. Unnecessary variables can increase noise in the model and cause uncertainty in predictions. In econometric analysis, the principle of parsimony aims to provide the best explanation using the least number of variables possible. In addition, including non-significant variables in the model may show high correlations with other independent variables and increase the multicollinearity problem. This can make it difficult to estimate and interpret model parameters. Removing meaningless variables helps avoid such problems.

Model 1 shows that a 1% change in the environment variable increases the Tobin's Q variable by 0.07% and the total asset turnover rate by 0.14%, while the governance variable decreases it by 0.07%. In Model 2, it was observed that a 1% change in total asset turnover increased the ROA variable by 0.04% and the sales growth rate by 0.17%, while the leverage variable decreased by 0.03%. In Model 3, it was concluded that a 1% change in the sales growth rate increased the ROE variable by 0.04%, the environment variable by 0.08%, and the governance variable by 0.019%.

RESULTS AND DISCUSSION

This study determined different relationships among the ROA, ROE, and Tobin's Q variables, which represent the financial performance of 21 companies in BIST 100, and the environmental, social, and governance scores that make up the ESG sub-dimensions. Findings regarding the variables taken to measure firm performance are as follows.

Effect of ESG sub-dimensions on ROA

The research findings show that the sub-dimensions that make up ESG are statistically insignificant on ROA. Table 7 shows that companies reporting ESG do not affect their ROA. According to the findings obtained, it was determined that the main hypothesis H1 and its sub-hypotheses were rejected. In addition, it has been determined that while the total asset turnover ratio and sales growth rate data set positively affect the ROA of the companies that make up the data set, the leverage ratio has a negative effect of 0.3%. The literature shows similar results regarding the effect of ESG factors on firms' ROA (Buallay, 2019; Qureshi et al., 2021).

Effect of ESG sub-dimensions on ROE

Table 7 shows that the E and G scores of the sub-dimensions that make up the ESG are statistically significant on ROE. It positively affects ROE, with an E score of 0.08% and a G score of 0.02%. According to the findings, it was determined that the H2b hypothesis, one of the sub-hypotheses of the H2 main hypothesis, was rejected. In addition, a statistically significant and positive effect on the market-to-book ratio, ROE, was determined. Firms' investments in E and G scores had an increasing effect on the ROE. The findings are different from those of some studies in the current literature. Per Kamatra and Kartikaningdyah (2015), Han et al. (2016), and Atan et al. (2018), the effect of ESG sub-dimensions on ROE could not be determined. The findings of our study differ from the existing literature in this respect.

Effect of ESG sub-dimensions on Tobin's Q

Table 7 shows that the E score has a positive effect of 0.07% on Tobin's Q and is statistically significant. Contrary to the E score, the G score has a negative effect of 0.08% on Tobin's Q, and the result is statistically significant. El Khoury et al.'s (2021) findings are similar to those in the study's results. The study stated that the E score had a positive effect on the market performance, while the G score had no effect on the market performance. However, according to our findings, a negative effect has been determined on the market performances of the companies that make up our G score data set. In line with the findings, it was determined that the H3b hypothesis, which is one of the sub-hypotheses of the H3 main hypothesis, was rejected. In addition, the total asset turnover ratio has been found to have a positive effect of 1.4% on Tobin's Q ratio of companies. Total assets are negatively and significantly correlated with Tobin's Q ratio. This indicates that small companies can be valued more in the market than large ones (Atan et al., 2018). It has been determined that the firm's age has a small (0.006%) negative effect on Tobin's Q. Considering the size of the 21 companies that make up our data set and the literature, it can be said that our obtained result is consistent.

According to the findings of our study, when examining the effect of the sub-dimensions constituting ESG on dependent variables, it is observed that environmental investments positively affect ROE and Tobin's Q ratios. This indicates that the market rewards companies for their environmental investments. This finding demonstrates that, in addition to enhancing their financial performance in the medium and long term by investing in areas outside their operations, companies may also improve their visibility and reputation in the markets. Indeed, it would be correct to assume that BIST 100 investors value CSR practices and consider these practices in their investments. Furthermore, these results support the findings of the studies conducted by Saygılı et al. (2022) and Ozer et al. (2023).

On the other hand, it was found that social investments did not significantly affect the variables representing financial performance. This result differs from studies that have concluded a statistically significant relationship between social investments and financial performance (Shen et al., 2016; Siueia et al., 2019; Wu et al., 2017). Additionally, existing studies indicate that increasing the social performance of firms does not affect their financial performance. Our findings parallel a study by Ozdarak and Akarcay (2022), which found no statistically significant relationship between ESG disclosures of firms listed on the Borsa Istanbul Metal Products Machinery Index between 2009 and 2018 and their financial performance. We conclude that ESG investments should be evaluated through market-based ratios that support stakeholder theory. Indeed, our findings support our assumption.

However, it was observed that investments made based on governance scores positively affected firms' ROE ratios. Nevertheless, according to our findings, the governance score negatively affected the firms' market performance (Tobin's Q) in our dataset. Although this finding differs from some studies in the literature (Ozdarak & Akarcay, 2022; Ozer et al., 2023), it is consistent with the results of many other studies (Perez de Toledo & Bocatto, 2008; Abdi and Càmara-Turull, 2022; Ghabri, 2022; Saygılı et al., 2022). Therefore, this finding regarding the governance score supports the negative synergy hypothesis.

In the findings, it was determined that any of the ESG sub-dimensions did not influence ROA. This finding is different from the findings of some studies in the literature (Bually et al., 2021; Velte, 2017; Saygılı et al., 2022). Given that ESG investments are long-term and future-oriented, it is foreseeable that there is no statistically significant relationship with the accounting-based ROA ratio, which is inherently short-term and past-oriented. Indeed, many studies in the existing literature have found that ESG criteria do not affect ROA (Alareeni & Hamdan, 2020; Nirino et al., 2021; Ozdarak & Akarcay, 2022; Ozer et al., 2023).

CONCLUSION AND IMPLICATIONS

This study focused on the activities of the 21 companies forming the BIST 100 index in Turkey regarding ESG criteria. The empirical effect of environmental, social, and governance sub-dimensions, which constitute ESG, on companies' financial performance was examined in the study. Panel regression analysis investigated the relationship between the ESG sub-dimensions and firm performance. As a result of the research, we found that environmental and governance scores significantly impact firms' financial performance. According to the research findings, the alignment of firms listed on the BIST-100 with environmental and governance sub-dimensions affects financial performance and market performance. Environmental investments positively influence firms' ROE and Tobin's Q ratios. Embracing governance sub-dimension negatively affects firms' Tobin's Q and positively influences ROE. Statistically significant results regarding the impact of the sub-dimensions constituting ESG on firms' ROA ratios were not found. These findings provide a new perspective on the different results of existing research. The results of our analysis demonstrate that the sub-dimensions of ESG have a significant impact on firms' financial performance.

In general, the research findings indicate that each ESG sub-dimensions has different effects on firms' financial performance. It would not be incorrect to assume that activities conducted by firms under CSR are interpreted differently by investors. Additionally, it is important to consider the macroeconomic structure, legal system, and level of financial development of the countries where firms operate. Studies have identified a regulatory effect of countries' legal systems on the relationship between environmental, social, and governance sub-dimensions and firm performance. Indeed, economic activities are built on trust, and the fundamental elements that provide trust are legal regulations. Investors prefer their capital to be legally protected and may hesitate to invest in countries where legal protection is weak. This situation is supported by various studies in the literature. It has been observed that firms operating in countries where legal protection is less effective or ineffective have a negative governance and firm performance relationship

(Ghabri, 2022). Indeed, our findings determined that the governance sub-dimensions had a negative effect on Tobin's Q ratios of the firms constituting our dataset.

Additionally, firms' performance is also influenced by the macroeconomic situation of countries. Fluctuations or shocks that may occur at the global or regional level can affect financial markets and, thus, firms. In such events, the extent to which financial markets and firms are affected also varies depending on countries' financial development. Since these environments can impact the relationship between firms' CSR activities and financial performance in the short to medium term, future studies need to analyze longer-term data and consider the macroeconomic structure and level of financial development of the countries where the studied firms are located. The research utilizes a dataset covering the period from 2011 to 2020. The primary reason for selecting this period is the limited number of firms disclosing the data and the difficulty in accessing these data. Indeed, this limitation constitutes one of the most significant constraints of the study. Therefore, future research could use datasets covering broader time intervals and examine the practices of other developing markets and other corporate groups in Turkey.

In future studies, consider the legal structure of the countries where the firms are located, especially when examining the effects of governance scores on firm performance. Additionally, by considering sectoral differences, board structure and characteristics, CEO duality, and other relevant factors, researchers can examine the impact of ESG and its sub-dimensions on firms' financial performance.

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Biographical notes

Melih Sefa Yavuz is an Assistant Professor in the Department of Banking and Finance at Istanbul Beykent University. He is a dedicated researcher in the field of finance, with a focus on digitalization, blockchain, sustainability, and financial markets. He has authored numerous national and international publications that contribute to the body of knowledge in these areas. In addition to his research, he is actively involved in the Quality and Strategy Development Department at Istanbul Beykent University, where he applies his expertise to enhance academic and operational excellence.

Hasan Sadık Tatlı conducts research in the fields of management and strategy. He has many publications nationally and internationally. He currently teaches management and strategy as an Assistant Professor in the Department of Business Administration at Istanbul Beykent University. His specific research areas include digitalization, responsibility, leadership, senior management teams, and dynamic capabilities. Additionally, Hasan Sadık TATLI serves as the Assistant Director at the Graduate School of Istanbul Beykent University, where he contributes to the development and administration of postgraduate programs.

Gözde Bozkurt conducts research in the field of econometrics. She has many national and international publications. She teaches research methods, econometrics, and economics courses as an Assistant Professor in the Department of Economics at Istanbul Beykent University. Her research themes include time series, health economics, environmental awareness, quantitative techniques, and mixed techniques.

Gökten Öngel works in the field of health management and is currently a physician at Istanbul Training and Research Hospital. He also conducts research in business management and has numerous national and international publications. His research themes include health management, health economics, business management, social responsibility, and leadership. Dr. ÖNGEL's work focuses on integrating medical expertise with business management principles to enhance healthcare outcomes and improve organizational effectiveness.

Authorship contribution statement

Melih Sefa Yavuz: Conceptualization, Data Curation, Writing – Original Draft Preparation, Writing, Review & Editing, Supervision, Revisions. **Hasan Sadık Tatlı:** Conceptualization, Writing – Original Draft Preparation, Formal Analysis, Writing, Review & Editing, Supervision, Revisions. **Gözde Bozkurt:** Methodology, Formal Analysis, Validation, Writing, Review & Editing, Revisions. **Gökten Öngel:** Conceptualization, Formal Analysis, Writing, Review & Editing, Revisions.

Conflicts of interest

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The impact of strategic management on organizational creativity and its influence on the financial performance of SMEs

Tuan Khanh Vuong¹ 

Abstract

PURPOSE: This research intends to help small and medium-sized enterprises (SMEs) in Ho Chi Minh City (HCMC) to understand the strategic management process. The study considers an inside-and an outside-in perspective and the intermediary role of organizational creativity in financial performance. It also aims to help SMEs achieve financial performance benchmarks and work towards sustainable development goals. This research is also significant and adds value to the performance management domain. Its overarching objective is to promote long-term business expansion through an exploration of the strategic management process and how organizational creativity and financial performance can be supported. **METHODOLOGY:** The sample data are collected from 411 SMEs in HCMC using convenience sampling. The data are rigorously screened and cleaned to select a reliable sample for analysis, and Smart PLS software is employed for data analysis to achieve the study's outcomes. **FINDINGS:** Factors such as the strategic management process, an inside-out perspective, an outside-in perspective, and the intermediary role of organizational creativity positively impact the financial performance of Vietnamese SMEs in HCMC. **IMPLICATIONS:** The results show that SMEs are making changes and influencing these factors to improve financial performance. This research contributes value and provides a holistic perspective on the strategic management process for Vietnamese SMEs in HCMC to improve financial performance. **ORIGINALITY AND VALUE:** The study offers insight into strategic management and highlights the pivotal role of creativity in managing the financial performance of enterprises. The overarching goal is to achieve sustainable development in an increasingly competitive environment. The study also provides a solid foundation for SME managers to restructure their operations for enhanced financial performance. It also offers valuable insights for future scholars to consider and apply in expanding available research models.

Keywords: SME, strategic management process, organizational creativity, financial performance, sustainable development goal.

INTRODUCTION

Karaev (2023) argues that understanding the complex corporate landscape and the fiercely competitive global market is needed for firms to have a comprehensive understanding of the market and maintain growth. Corporate performance is emphasized in theoretical and practical studies, and it remains a primary concern for executives in modern business organizations (Mzera, 2024). Of particular concern are the effects of different approaches to company success. Taking a modern approach to strategic management is essential to enhancing company performance in the context of global competition. It requires that external and internal components of a strategic plan are considered during the planning

¹ Tuan Khanh Vuong, Faculty of Marketing and International Business, HUTECH University, No. 475A Dien Bien Phu st., Ward 25, Binh Thanh District, Ho Chi Minh City, Vietnam, e-mail: vk.tuan@hutech.edu.vn (ORCID: <https://orcid.org/0000-0003-1364-6831>).

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process. This approach will give businesses a comprehensive understanding and will maximize the potential for resource exploitation, ultimately leading to sustainable development. Additionally, it allows enterprises to achieve their goals by taking into account the current competitive landscape.

Small and medium-sized enterprises (SMEs) are crucial in addressing unemployment and driving economic growth (Chauhan et al., 2019). SMEs play a crucial role in driving local, national, and regional economies (Kiranantawat & Ahmad, 2023) and promoting economic growth. SMEs reduce unemployment and, as supporting entities, supply larger corporations with vital resources and tools and enhance the effectiveness of manufacturing and commercial operations. However, SMEs exhibit a limited degree of innovation and technological advancement. Nasir et al. (2020) argue that a lack of innovation, effective leadership, and performance are responsible for these issues. These firms are crucial to the global economy and national development, as they often support large corporations and products that are essential for the local or international economy. Strategic management is vital to the success of large organizations and small businesses; this is especially true in emerging markets. Maximizing business success requires prioritizing strategic management and innovation. Senior executives in SMEs must effectively identify and maintain their company's sustainable competitive advantage, considering the entirety of internal and external factors. Performance assumes a central role in SMEs' strategic decisions, corporate culture and evaluation criteria, all of which are crucial to their success and development. The 'inside-out' approach emphasizes internal strengths, while the 'outside-in' perspective takes account of market dynamics. These perspectives form a robust management framework for long-term enterprise development. In addition, as a result of current opportunities to explore dynamic markets, SMEs' management and business perspectives are limited, particularly with respect to the implementation of strategic activities. SMEs need a comprehensive internal and external vision so that they can reduce their risks and seize market opportunities to maximize performance.

All organizations, especially SMEs in the developing world, should engage in effective strategic management to succeed (Alnawas & Abu Farha, 2020). Nguyen et al. (2023) investigate the associations between strategists' perspectives (both internal and external), creative organization and financial performance in small businesses in Vietnam. Organizational creativity has a significant role in developing the ability to innovate to produce new products, processes, and organizations. It also has a subjectively-based effect (De Vasconcellos et al., 2019). Businesses require a culture of innovation to successfully develop new products and services and enhance processes (Alosani et al., 2020). The literature recognizes the importance of innovation for corporate success and national economic growth (Nasir et al., 2022). Companies can enhance their operational effectiveness through innovation and strategic planning (Karaev, 2023). This research thus focuses on the significance of a strategic management process that incorporates inside-out perspective and outside-in perspective, as well as organizational creativity. These factors all impact the financial performance of SMEs in Ho Chi Minh City (HCMC) and are key to achieving long-term development in the competitive global market. This study is also intended to enhance the financial effectiveness of SMEs, preparing them for leadership, reorganization, innovation, and growth in the contemporary business environment.

LITERATURE REVIEW

The resource-based view (RBV) suggests that a company gains its competitive edge more from its internal resources and abilities rather than its position in the external market (Monday et al., 2015). Achieving a competitive advantage depends on the distinct resources and skills that an organization possesses rather than market advantages and disadvantages. According to the RBV, organizations can gain a competitive edge and improve their performance by acquiring and effectively managing specific categories of resources. A company's resources include a broad range of assets, capabilities, organizational practices, inherent characteristics, information, knowledge and other elements that are within its direct influence or control. These resources allow the firm to formulate and implement strategies directed towards improving its operational efficiency and overall effectiveness (Barney, 1995). With respect to strategic management, the RBV posits that the primary determinants of exceptional company performance are closely linked to the characteristics of its resources and capabilities, which, according to Peteraf and Bergen (2003), are valuable and challenging to imitate. The organization's resources can give it a competitive edge, leading to improved performance (Ujwary-Gil & Potoczek, 2020). The strategic development of all resources within enterprises and a focus on human resources can improve overall efficiency. Other resources, such as tools, equipment and materials within the business, as well as financial resources, are essential to long-term business success. Strategic development should also prioritize and innovate in these areas.

Adejuwon (2018) argues that contingency theory allows a particular situation to be examined to isolate the factors influencing the decision-making process. Strategic management theory is particularly important given the ever-changing field and the significant uncertainty in the corporate landscape. The strategic management process is also pivotal in an organization's ability to adapt and innovate, influencing its financial performance and, in turn, enhancing overall operational efficiency. This underscores the need to consider internal and external perspectives to gain a competitive edge in the current market. The RBV also suggests that a company's internal resources are its primary competitive advantage. The market-based approach suggests that incorporating customer and competitor ideas into successful strategies is a more comprehensive approach. Tedla (2019) states that to execute a strategy, an organization should have sufficient resources, a well-defined decision-making procedure and have a transparent, supportive culture, modern information technology, rewarding and motivating systems, and communication channels that are streamlined. The strategic management process can include a dynamic perspective on capabilities, which involves the organization's capacity to respond to alterations in its external environment. This is accomplished by promoting innovation and internal improvements to the company's management, which will ultimately result in the company's successful development.

Financial performance

The concept of corporate performance treats the organization as a unified assembly of productive resources comprising human, physical and capital assets that collaborate to achieve a common objective (Barney, 1995). Jean et al. (2018) explore how different strategic orientations affect innovation performance and find that companies adopting a customer-centric approach tend to have better innovation performance. Corporate performance thus encapsulates a business's ability to efficiently achieve its goals and its capacity for innovation. Vuong and Rajagopal (2022) propose that firm performance includes financial and non-financial aspects. Performance against financial goals is measured in terms of revenue and profit, while non-financial performance is measured in terms of employee and customer satisfaction and process innovation. Companies should adopt a holistic perspective that systematically includes non-financial components (resources, employees, and customers) and takes account of the culture of innovation and the corporate climate. This approach will have a significant role in enhancing the company's financial effectiveness and maintaining its sustainability.

As Powell (1996) explains, a corporation can attribute its innovation to internal and external resources, including knowledge, abilities and competencies. Employees' perspectives regarding the organization's policies, procedures, regulations and personal connections have a significant impact on the creation of a corporate climate that promotes creativity and innovation (Shafique et al., 2019). A person's degree of creativity at any given time is influenced by internal and external creative factors (Ndudi & Ononye, 2022). As a result, to achieve their management goals, SMEs should innovate and be creative in the production of business goods while also encouraging their employees to learn and think creatively to acquire knowledge, abilities and the appropriate attitudes in the rapidly changing business environment.

George et al. (2019) state that organizational performance is the speed with which and degree to which a company successfully meets its business objectives. The evaluation of organizational performance involves an assessment of an organization's results against its intended outputs or goals (Itohan et al., 2024). Tareque and Islam (2023) examine the relationship between leadership behavior, emotional intelligence, competitive advantage, corporate strategy and performance. The results of their study indicate that the implementation of relationship-building behaviors has a considerable impact on a company's performance, leading to a competitive advantage. Karaev (2023) indicates that firms can enhance their performance by incorporating innovation and strategic planning processes. Moreover, improving financial performance by achieving overall financial goals and profits is crucial to achieving management, business, and production goals and sustainable development. The strategic management process can also facilitate the alignment of SMEs with the efficient use of internal resources in response to market shifts and to promote effective growth.

Strategic management process

A succinct description of strategic management focuses on the process by which managers make informed decisions and take corresponding actions to develop and implement a strategic plan, all with the ultimate goal of achieving organizational objectives (Wheelen & Hunger, 2007). Strategic management involves charting the organization's future path, establishing goals for performance, crafting plans to attain these goals and implementing those while adapting to both internal and external factors. Although the inside-out and outside-in methods may seem to be in opposition, there is a growing literature that advocates for their combined usage (Frau & Cabiddu, 2016). The outcome is a mixed strategy

that combines the advantages of the outside-in and inside-out perspectives (Frau et al., 2020). To maintain their ongoing presence, organizations should choose a suitable business strategy that allows them to make the most of environmental opportunities while taking into account their strengths and weaknesses (Ghaemi-Zadeh & Eghbali-Zarch, 2024). Therefore, SMEs should adopt a dual perspective in the strategic management process to achieve their performance goals. The outward perspective involves understanding the market and customer and partner expectations, among other factors. The inward perspective involves assessing the SME's potential and capabilities, including its financial situation, quality of human resources, production status, and corporate culture. This comprehensive viewpoint is essential for rational business management and innovation for SMEs to achieve common long-term business objectives.

Dess et al. (2007) demonstrate that strategic management involves a comprehensive process of in-depth assessment, strategic decision formulation and implementation to establish and maintain competitive advantage. Strategic management is a continuous process that involves the examination and supervision of a company and the industries in which it operates. This involves analyzing competitors, creating goals and strategies to be competitive with current and potential rivals and consistently assessing these in response to changing conditions, for example, technological advancements, new competitors, economic shifts and alterations in the social, financial, or political landscape (Muogbo, 2013). In a dynamic business environment, each organization should tailor its strategic management based on its distinctive strengths and the situation's specific demands (Adejuwon, 2018). In addition, Itohan et al. (2024) suggest that organizations should adopt strategic management approaches to boost their performance. This involves setting clear goals, refining decision-making procedures, efficiently distributing resources, adjusting to changing environments, encouraging creativity, maintaining organizational unity and using performance metrics effectively. The company should carefully consider the strategic management process to encourage strategic innovation internally. The focus should be on core issues such as human resources, physical resources, and financial factors to innovate in a way that is aligned with the firm's development goals. These elements allow SMEs to achieve business success by enhancing production, operations and financial efficiency. In turn, this supports their position in the competitive market.

Frau et al. (2020) state that the outside-in approach means prioritizing the well-being of external stakeholders, including consumers, shareholders, suppliers, and creditors. The objective is to produce value solutions that effectively meet the demands of these stakeholders. In the realm of strategic entrepreneurship, SMEs can strategically utilize their resources to recognize and take advantage of entrepreneurial opportunities (Alshagawi & Mabkhot, 2024). Thus, SMEs' strategic management processes should include an inside-out and outside-in perspective to optimize resource efficiency and capitalize on the external market opportunities crucial for performance. Based on the analyses above, the following hypotheses are proposed:

H1: The strategic management process positively affects Vietnamese SMEs' inside-out perspective.

H2: The strategic management process positively affects Vietnamese SMEs' outside-in perspective.

Inside-out perspective

Organizational dynamic capabilities is a concept originating from evolutionary economics and is a dynamic version of the inside-out perspective (Saeed et al., 2015; Day, 2011; and Newbert, 2007). Developing internal action plans, devising successful tactics to boost organizational effectiveness, defining a coherent future path, cultivating collaboration, adeptly navigating external changes and uncertainties, efficiently managing processes and personnel and making well-judged decisions and priorities are vital (Momoh & Itohan, 2023). The inside-out perspective suggests that a company should focus on its internal resources rather than external opportunities. Successful companies focus on developing a strong portfolio of abilities and resources by taking advantage of internal resources, including human capital, management processes, and financial assets. SMEs can use this method to implement multiple efforts in manufacturing, business, and operations. Achieving this goal requires a significant financial commitment and a forward-thinking mindset, both of which have an effect on the culture and personality of the small business owner with respect to long-term success. Instead of solely focusing on physical assets, this approach focuses on maximizing capital in order to achieve disproportionate growth and develop special abilities.

The inside-out orientation, rooted in economics and strategic management, focuses on an organization's internal dynamics and its ability to achieve exceptional performance by adeptly nurturing, obtaining, using, and deploying strategic resources. These resources are unique, valuable and rare characteristics that are challenging for competitors to replicate (Miller et al., 2002). SMEs should allocate resources efficiently to cultivate and fortify their distinctive competencies, talents

and assets to become highly functional and adaptable in the current market. This commitment transcends mere financial investments and includes valuable intangible resources, such as intellectual property, human capital and technological infrastructure by which the organization can optimize its value. By nurturing and augmenting these internal resources, SMEs can enhance their potential for achieving enduring business activities and sustainable business, enabling them to successfully adapt to long-term activities in the new era.

Hung et al. (2021) indicate that the drawbacks of scale can negatively impact the growth trajectory of private companies in Vietnam; these companies struggle to obtain capital and face limitations on their production or productivity, impediments to growth, constraints on their competitiveness, and negative impacts on their growth trajectory. A strategist's outsider perspective can enhance the creativity of Vietnamese SMEs (Nguyen et al., 2023). The inside-out perspective is also important to those who want to promote creativity and innovation within small businesses in Vietnam. This approach grants power to small businesses to utilize their internal resources and promote a culture of innovation, as well as develop strategies that take advantage of their existing resources, all of which are beneficial in the real world. Taking this perspective can have long-term benefits and promote the growth and prosperity of small businesses in Vietnam. Additionally, internal resources and abilities have a significant positive impact on an organization's innovation and creative abilities, helping the company to create resources and utilize these to gain a competitive advantage.

Hung et al. (2021) study private Vietnamese enterprises and find that among the factors associated with firm size, total assets stand out as the primary determinant of firm performance, followed by total labor and the rate of growth. Embracing an inside-out perspective can improve internal resources and benefit the financial outcomes of Vietnamese SMEs by harnessing their inherent strengths and abilities. This strategy aids SMEs in adapting to the market, optimizing resource utilization, and achieving sustained growth. However, it is imperative that Vietnamese SMEs remain aware of external market conditions to ensure a comprehensive and well-balanced business strategy from inside and outside perspectives. Internally, a strategist can significantly boost the innovation and creativity of Vietnamese SMEs. This approach to innovation is conducive to innovation and has the potential to enhance financial performance by utilizing internal resources to deal with environmental change. The RBV centers around the value of internal resources, while the dynamic capabilities theory focuses on their adaptability. As such, the inside-out approach is probably beneficial for financial results and will facilitate the company's survival and growth. The facts above support the formulation of the following hypothesis:

H3: The inside-out perspective positively influences the organizational creativity of Vietnamese SMEs.

Outside-in perspective

The outside-in perspective underscores the importance of crafting a strategic outlook focused on market positioning and understanding and adapting to external change (Nguyen et al., 2023). The inside-out perspective focuses on organizational resources and then considers competitors and customers. In contrast, the outside-in perspective reverses this order, starting with customers and competitors and then assessing the firms' response to them, implicitly considering organizational resources (Saeed et al., 2015). Strategists who favor an outside-in perspective prioritize acknowledging the external business environment when devising organizational strategies and capitalizing on market opportunities. Flourishing SMEs are market-driven, continuously adjusting to seize opportunities, confront challenges, meet customer demands and respond to competitive pressures. This approach involves evaluating market opportunities, strategically positioning the organization, understanding the dynamics among market players, researching changing customer behavior, and effectively overcoming obstacles to the implementation of business strategies that favor long-term success.

Tallman (1991) argues that taking an outside-in approach allows the identification of customers' obvious and hidden needs. This includes valuable information regarding competitors' abilities, strategies, and products. This method prioritizes providing customers with exceptional value, recognizing the importance of the composition of the market for a product, and understanding the direct relationship between market structure and future revenue. Additionally, SMEs that adopt an outside-in perspective have a greater chance of market success if they engage in customer-driven processes to develop superior products or services. This method focuses on meeting customer needs, recognizing demand gaps and addressing issues in the market by combining external information and resources. This approach supports the capacity of small businesses to succeed in a competitive market.

There is considerable research supporting the idea that embracing an outside perspective makes a significant contribution to achieving positive results, particularly in terms of innovation (De Luca & Atuahene-Gima, 2007). The outside-in perspective helps SMEs gain an overall view of their market and customers. Using this perspective in combination with business innovation and creativity allows them to adapt and exploit the business's potential, aiding their survival and growth. Based on the above factual observations and in-depth analyses, the following hypothesis is proposed:

H4: The outside-in perspective positively influences Vietnamese SMEs' organizational creativity.

Organizational creativity

The growing popularity of creative industries demonstrates the importance of creativity in the real world. In a competitive environment, this resource becomes even more important as it allows quick problem-solving (De Vasconcellos et al., 2019). Balazs et al. (2023) state that innovation is essential to maintaining a significant lead, providing value to customers, and increasing market share. Prioritizing creativity in the management process is essential for developing new concepts and quickly solving company problems in a complex, dynamic environment. Creativity is also essential for developing new management concepts, new products and services, manufacturing technologies, business processes, and customer service, all of which help companies adapt to customers' changing needs and the ever-changing business environment.

Fetrati et al. (2022) describe creativity as the capacity to produce original ideas through the innovative application of prior knowledge. The creative process involves connecting existing knowledge and experiences to devise unique solutions to challenges. In addition, there is an urgent need to expand research efforts focused on creativity in SMEs across a broad spectrum of subjects (Castillo-Vergara & Lema, 2022). Entrepreneurial creativity refers to the creation and execution of new and relevant concepts aimed at launching a new business endeavor (Amabile, 1997). Renko et al. (2009) suggest that innovation involves blending an organization's internal expertise and insights with the external needs of consumers and users to create a distinct and novel approach. Innovation is widely recognized as essential for the economic sustainability of businesses and nations. It is fundamental in achieving long-term success and establishing a competitive edge, as Baker and Sinkula (2002) emphasize. Moreover, creativity and innovation are essential for a company's overall success and performance (Anderson et al., 2014). SMEs wishing to secure a competitive advantage should foster innovation and cultivate creativity. Hence, creativity and innovation assume a pivotal role in the sustainable development of SMEs, as they allow them to adjust to market fluctuations and address management challenges. Creativity in SMEs will help them to change and adapt to the evolving market. As the competitive landscape intensifies and customer preferences shift, SMEs should innovate to continually offer new products and services, serve customers, generate profits, and thereby facilitate business growth.

Numerous studies present convincing evidence of the association between embracing an external perspective and achieving positive outcomes in innovation (Kahn, 2001). According to Im and Workman (2004), an external focus or an outside-in orientation in high-tech enterprises is linked to improved innovation, creativity, and overall company performance. It is impossible to overemphasize the significance of innovation in modern businesses to catalyze and sustain competitive advantage (Zhou et al. 2021). Creativity and innovation play a crucial role in ensuring the survival of enterprises and in promoting their long-term and sustainable growth. Creativity can help SMEs adapt to changes in the business environment and generate profits; therefore, stimulating a culture of creativity within the business is essential. This analysis and the underlying empirical evidence motivate the following proposed hypothesis:

H5: There is a positive relationship between SMEs' organizational creativity and financial performance.

The strategist's perspective, which can be either an inside-out or an outside-in orientation, is a vital aspect of strategic management (Nguyen et al., 2023). The strategic management process, incorporating internal and external perspectives, can help SMEs gain comprehensive insights and enhance efficiency in internal operations while seizing market opportunities. Therefore, the strategic management process is crucial in improving SMEs' financial efficiency. Organizational creativity plays an equally important role in innovating business activities, promoting creativity in product development, improving management processes, and enhancing customer satisfaction. Organizational creativity is a source of development and adaptation in today's fiercely competitive market. This study leverages practical experience and includes a comprehensive analysis based on relevant studies, taking into account the connections between the suggested hypotheses, including an inside-out perspective, an outside-in perspective and the intermediary role of organizational creativity in financial performance. The study's conceptual framework is set out below.

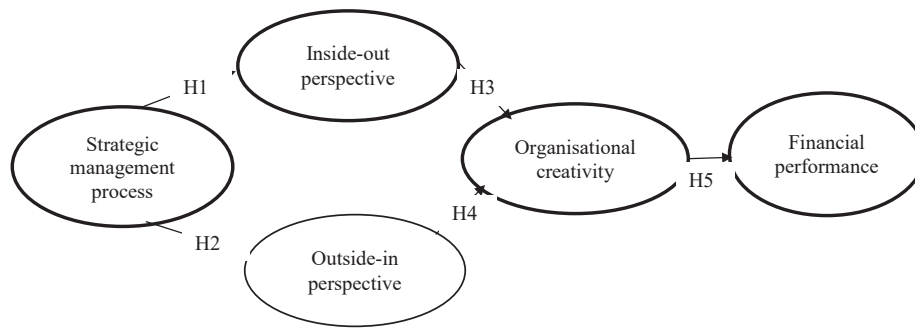


Figure 1. Conceptual framework for this study

METHODOLOGY

This study analyses SMEs operating in HCMC, which, as one of Vietnam’s principal urban centres, hosts myriad businesses and offers a rich sample pool for research in manufacturing and service-based enterprises. This study employs a convenience sampling method (selecting samples based on convenience in HCMC). Sampling is conducted based on the ease of access or convenience of the sampling units for this research.

The research sample is diverse and representative, including technicians, specialists, middle managers, and directors of SMEs in HCMC. The convenience sampling method enables the collection of a diverse range of participants, including technicians, experts, middle managers and directors of SMEs in HCMC, thereby ensuring a diverse research sample. This convenient sampling method was used to collect data and analysis was then conducted to obtain the research results.

Regarding the measurement of variables in the research model, the scales of measurement are adapted from prior studies and customized to suit the research context in Vietnam. Specifically, the strategic management process (SMP) construct consists of *SMP1*, *SMP2*, *SMP3*, *SMP4* and *SMP5*, following Adejuwon (2018). The inside-out perspective (IOP) construct includes *IOP1*, *IOP2*, *IOP3*, *IOP4* and *IOP5*, referencing and adapting the construct in Meyer (2007). The outside-in perspective (OIP) consists of four items referenced by Meyer (2007): *OIP1*, *OIP2*, *OIP3* and *OIP4*. This study references and adapts the organizational creativity (OCR) construct from Mikalef & Gupta (2021), and the measurement scale includes *OCR1*, *OCR2*, *OCR3*, *OCR4* and *OCR5*. The financial performance (FIP) construct is adapted from Adejuwon (2018), and the measurement scale includes *FIP1*, *FIP2*, *FIP3*, *FIP4* and *FIP5*.

The survey questions were collected from SMEs in HCMC between May 2022 and August 2023. Data were collected and cleaned, and good samples were selected for analysis; that is, surveys that were not missing information or answered carelessly. Problematic observations were discarded, and suitable ones were selected for analysis. The valid data collected were then imported into the Smart PLS software for analysis to assess the reliability of the measurement scales, scrutinize the suitability of the research model, and extract valuable research findings. This evaluation supports the formulation of conclusions and observations regarding the research outcomes. Table 1 presents the information collected, detailing the demographic characteristics of the study participants.

Table 1. Demographic characteristics

	Frequency	Percent	Valid percent	Cumulative percent
Gender				
Male	249	60.6	60.6	60.6
Female	162	39.4	39.4	100.0
Total	411	100.0	100.0	
Qualification				
Certificate	47	11.4	11.4	11.4
Diploma	125	30.4	30.4	41.8
Bachelor	232	56.5	56.5	98.3

	Frequency	Percent	Valid percent	Cumulative percent
Postgraduate	7	1.7	1.7	100.0
Total	411	100.0	100.0	
Position in company				
Technician	18	4.4	4.4	4.4
Specialist	234	56.9	56.9	61.3
Manager	138	33.6	33.6	94.9
Director	21	5.1	5.1	100.0
Total	411	100.0	100.0	
Working experience				
Less than 1 year	37	9.0	9.0	9.0
1–3 years	198	48.2	48.2	57.2
4–9 years	125	30.4	30.4	87.6
Over 10 years	51	12.4	12.4	100.0
Total	411	100.0	100.0	

Table 1 reveals that the percentage of men participating in the survey was 60.6%, while women accounted for 39.4% of the total sample of 411 participants. The characteristics of the research sample reflected in the data include gender, education level, job position within the company and work experience, as detailed in Table 1. The study sample is diverse and includes technicians, specialists, managers and directors as participants to provide a diverse range of perspectives on the research issue. The study pays special attention to the professional backgrounds of the individuals in the sample-gathering process to achieve a diverse range of participant viewpoints. The study also evaluated employees with experience ranging from 1 year to over 10 years. For specific information, refer to Table 1.

RESULTS AND DISSCUSION

The analysis criteria here required items to be greater than 0.7 to meet statistical standards. Item OCR5 is excluded because its value is less than 0.7. Rerunning the analysis for a second review results in the exclusion of item OCR5. Given that all items then met the 0.7 threshold, the conclusion is that all items are valid.

DeVellis (2012) indicates that if Cronbach's Alpha for all scales is greater than 0.7, then these are all reliable. The findings in Table 2 clearly indicate that the value of Cronbach's Alpha exceeds 0.8 for all factors, suggesting that the measurement scales meet the requirements for reliability.

Table 2. Cronbach's alpha, composite reliability, and average variance extracted

Variables	Cronbach's Alpha	rho_A	Composite Reliability	Average Variance Extracted (AVE)
FIP	0.845	0.848	0.890	0.618
IOP	0.821	0.823	0.875	0.583
OCR	0.864	0.866	0.908	0.711
OIP	0.808	0.813	0.874	0.634
SMP	0.834	0.836	0.883	0.600

Following the criteria outlined in Bagozzi and Yi (1988), when the composite reliability (CR) coefficients for all measurement scales exceed 0.7 and all AVE values are greater than 0.5, the convergent validity of the scales is confirmed. The data in Table 2 clearly demonstrate that all measurement scales fulfill these requirements, ensuring convergent validity.

Henseler et al. (2015) state that where all Heterotrait-Monotrait (HTMT) values fall below 0.9, discriminant validity is guaranteed. The data in Table 3 make evident that all HTMT values meet the statistical requirements, confirming discriminant validity.

Table 3. Heterotrait-Monotrait Ratio (HTMT)

Variables	FIP	IOP	OCR	OIP	SMP
FIP					
IOP	0.388				
OCR	0.780	0.613			
OIP	0.522	0.731	0.819		
SMP	0.194	0.609	0.460	0.765	

Using 5,000 bootstrap samples is a robust approach to assessing the structural model. The findings in Table 4 indicate that all the connections between the variables in the model are statistically acceptable, supported by p-values less than 0.05.

Table 4. Mean, STDEV, t-values, p-values

Paths	Beta (β)	Sample Mean (M)	Standard Deviation (STDEV)	t statistics ($ O/STDEV $)	p-values
IOP -> OCR	0.167	0.170	0.047	3.5510	0.000
OCR -> FIP	0.668	0.670	0.029	23.289	0.000
OIP -> OCR	0.589	0.588	0.041	14.281	0.000
SMP -> IOP	0.510	0.513	0.040	12.826	0.000
SMP -> OIP	0.634	0.636	0.036	17.793	0.000

The results in Table 4 make evident that all hypotheses in the study model have been supported (all p-values < 0.005). Therefore, the hypothesised relationships are statistically supported: *SMP* has a significant positive effect on *IOP* ($\beta = 0.510$; P-value = 0.000 < 0.005); *SMP* has a significant positive effect on *OIP* ($\beta = 0.634$; P-value = 0.000 < 0.005); *OIP* has a significant impact on *OCR* ($\beta = 0.589$; P-value = 0.000 < 0.005); *IOP* has an effect on *OCR* ($\beta = 0.167$; P-value = 0.000 < 0.005); *OCR* has a significant positive effect on *FIP* ($\beta = 0.668$; P-value = 0.000 < 0.005). In summary, the model is statistically meaningful, and the hypotheses are supported.

The variance inflation factor (VIF) is a statistical tool employed to evaluate multicollinearity within a regression model (Table 5). An elevated VIF, surpassing a predefined threshold (e.g., 10 or 5), suggests the presence of multicollinearity among the independent variables in the regression model. This can impact the model's inferences and the estimations of the regression coefficients.

Table 5. Inner VIF values

	FIP	IOP	OCR	OIP
FIP				
IOP			1.561	
OCR	1.000			
OIP			1.561	
SMP		1.000		1.000

Hair et al. (2011) state that the condition of all inner VIF values remains below 5, suggesting the absence of multicollinearity within the model. This study shows that the inner VIF values consistently fall below this threshold, implying the absence of multicollinearity in the model.

Several studies in the literature consider the influence of strategic management on organizational performance (Monday et al., 2015; Omar et al., 2020; Kumar, 2021; Aliyu et al., 2022; Gede & Huluka, 2023). Adejuwon (2018) finds that strategic management positively impacts the financial performance of manufacturing companies, and Gede and Huluka (2023) find that strategic management emphasizes the harmonious creation of human resource practices to enhance the expertise, competencies and capabilities of employees. The aim is to fortify competitive strategies and achieve business objectives. Strategic management is particularly relevant, not only in academia but for practical purposes. Its implementation in SMEs' business and management processes should enhance their financial performance. The strategic management of SMEs should focus on carefully analyzing market opportunities, customer preferences, and

changes in the competitive landscape. Internally, the SME should optimize processes that relate to budgeting, human resource management, recruitment, and reasonable training. They should also build a corporate culture that encourages employee creativity to generate new ideas in production, business, and management activities to improve business outcomes. In addition, the strategic management process should link the inside-out and outside-in perspectives to balance SMEs' internal resources, seize external market opportunities, and thereby maximize financial efficiency.

The findings of my research support Hypothesis 1, which posits that the strategic management process has a positive impact on the inside-out perspective of SMEs in HCMC ($\beta = 0.510$, $p\text{-value} < 0.005$). This shows that a strategic management process that takes an inside-out approach has a significant impact on the financial success and performance of small businesses in the competitive commercial environment of HCMC. This essential process requires top managers to include an internal and external perspective while integrating principles of creativity and an entrepreneurial spirit; this will allow the SME to effectively respond to changing customer preferences, market forces, and uncertainty. Donkor et al. (2018) indicate that there is a significant, positive association between achieving strategic goals and achieving financial success. Small businesses in HCMC should exercise caution regarding the alignment of performance with an internal perspective; they should maximize the probability of a strong association when executing the strategic process. Achieving this goal in financial performance is dependent on the SMEs' careful and specific planning, dedicated implementation and the capacity to alter strategies as necessary. It is important to understand that the strategic management process is not always linear. Modification may be needed, depending on the particular circumstance and the business's environmental context. Furthermore, small enterprise's management should consider and adapt to particular business scenarios. SMEs can engage in strategic management, uphold sustainability, and meet financial targets if they can master these core skills. Small firms must consistently assess, learn, and adjust their strategies to stay competitive in the ever-changing business market, and it is thus essential to engage in strategic management.

The findings of this research also support Hypothesis H2, which posits that the strategic management process has a notable and positive effect on the outside-in perspective ($\beta = 0.634$; $p\text{-value} = 0.000 < 0.005$). The strategic management process is beneficial to SMEs in HCMC, as it emphasizes the important role of the outside-in or external perspective and responding to external forces and changes to achieve financial performance. This external perspective can support SMEs in HCMC in making informed decisions, maintaining their competitive position, and achieving their long-term goals. HCMC SMEs should take the external perspective into account and consider the market, customers and competitors to design a strategy that is both effective and sustainable. Additionally, when SMEs take an external perspective, they have a full understanding of the situation, which enables them to comprehend and analyze the market and examine all of the information to identify potential opportunities. They can then take advantage of internal resources to implement strategies and maximize profits. This perspective facilitates understanding and alterations that are relevant to business development and taking advantage of market opportunities to generate revenue.

Nguyen et al. (2023) suggest that an inside-out orientation that prioritizes internal strengths, self-awareness, continual enhancement and nurturing a sense of purpose all contribute to creating an environment conducive to creative thinking. Regarding Hypothesis H3, the inside-out perspective positively influences the organizational creativity of Vietnamese SMEs ($\beta = 0.167$; $p\text{-value} < 0.005$). The inside-out perspective is an approach SMEs can use to focus on strengthening their internal assets and inherent value to capture the attention of employees and generate creativity in management, business, and manufacturing processes to achieve financial performance.

Applications of the inside-out perspective advance creativity within SMEs in HCMC in the following ways. First, understanding fundamental values requires that SME executives have a comprehensive understanding of their business's core values, the customer solutions they provide and the unique attributes of their products or services that differentiate them from competitors. Second, organizational development requires SMEs to formulate a strong and inspiring mission and vision for their business. These strategic statements can guide the entire organization and inspire its customer base. Third, HCMC SMEs should allocate substantial resources to research and development (R&D) and the creation of new products. Regular investments of time and finances in enhancing product and service quality through R&D are crucial for attracting and maintaining a loyal client base. Fourth, human resource development requires that organizations prioritize training and personnel development, which are essential for remaining adaptable in a constantly changing market. Ensuring that employees can become experts in their respective areas is pivotal, guaranteeing the delivery of high-quality solutions to customers and bolstering the SME's reputation. Finally, SMEs should optimize their internal management processes and focus on doing so to stay competitive. This involves a continuous effort to maximize the potential of products, services, and business procedures. Adopting an inside-out perspective can offer management insight into SME

resources and allow comparison with the market. This understanding of the market fosters innovation and creativity within the workforce, encouraging them to learn, innovate and adapt to external market dynamics. Consequently, they work diligently to implement strategies, leading to their ultimate success and development.

Regarding Hypothesis H4, an outside-in perspective has a positive influence on the organizational creativity of Vietnamese SMEs ($\beta = 0.589$; p -value < 0.005). Hence, the outside-in perspective assumes a pivotal role in the management of SMEs in HCMC. It equips SME managers with an external viewpoint on the market and fosters organizational innovation to realize common objectives in business management. Whitley and Puto (2020) indicate that a strategist who uses an outsider's perspective emphasizes understanding the external environment while formulating a company strategy. Other studies, such as Nguyen et al. (2023), demonstrate the value of taking an outside-in perspective and creating a creative corporate environment that enhances performance and competitiveness. SME managers in the HCMC region should thus promote a focused external approach that involves extensive research on the market and competition. This method allows a comprehensive understanding of the SME's assets, liabilities, opportunities, and threats in the larger global competitive landscape. This analysis is crucial for identifying opportunities and challenges for small businesses. Additionally, the management of SMEs in HCMC should prioritize understanding their customers and value systems by understanding customers' interests and perceptions and the values associated with its products or services. These concepts are essential to creating quality products and services that result in customer satisfaction. Additionally, small businesses should concentrate on establishing their brand and increasing their popularity in the global market; this will increase their market share. This involves employing digital advertising and social media marketing across various platforms to create a powerful brand reputation that will expand the audience, generate revenue, and increase business opportunities for HCMC SMEs. Moreover, managers of SMEs in HCMCs should ensure that they remain adaptable and poised for growth in the rapidly changing business environment. Moreover, they should closely monitor key business and management metrics and apply management indicators and performance measurements to track and assess the implementation of the outside-in strategy. This may involve key performance indicators (KPIs) for evaluating employee and customer satisfaction and market trends to formulate well-informed strategies for product and service delivery.

Donkor et al. (2018) find that financial success is closely associated with the ability to innovate. Additionally, the integration of creative abilities has a significant effect on financial performance, improving financial performance. Nguyen et al. (2013) emphasize the importance of recognizing organizational creativity to mediate the relationship between strategy and financial performance. As a result, companies that prioritize innovation and creativity may take advantage of their resources and potential in the ever-present business landscape, leading to a competitive advantage. In addition, Hypothesis H5 posits a significant relationship between organizational creativity and the financial performance of SMEs ($\beta = 0.668$; P -value < 0.005). As such, this research centers on the role of organizational creativity in combining the inside and outside perspectives on financial performance. This highlights the significance of creativity in the various approaches that can be employed to achieve financial success and diversity. This research confirms existing studies, such as Saeed et al. (2015); the authors identify the importance of creativity in the association between various attributes and company performance. As a result, promoting the creativity of staff is of paramount importance to the management of small businesses in HCMC, Vietnam. In strategic management, creativity is crucial to driving business growth and improving financial performance. Managers can promote creativity in the workplace by creating a positive environment that promotes the development of ideas and innovation and providing the required resources and opportunities. Creative destruction begins with creating an open environment that allows everyone to discuss their ideas and proposals without fear of judgment. This can promote a culture of innovation that is significant in improving the long-term financial performance of an organization.

Nham et al. (2016) show that the concept of innovation, which includes product, process, marketing and organizational innovation, is recognized as essential to businesses' long-term survival and growth. These early attempts not only create value but also grant competitive advantages to companies that succeed. Additionally, to maintain a competitive advantage, a company should have the capacity for innovation that is consistently altered by the evolution of the environment (Baláz et al., 2023). Furthermore, integrating creativity into the organizational culture enhances non-financial objectives, thus boosting financial efficiency. Vietnamese SMEs in HCMC should innovate in production, business processes, and customer care to increase productivity and decrease expenses. This will improve financial performance in the face of competition and foster sustainable growth.

Implications for theory and practice

By enhancing the theoretical understanding of the strategic management process, this study highlights the importance of organizational creativity and both inside-out and outside-in perspectives in managing a company's financial performance. The ultimate goal is to develop knowledge regarding the important role of strategic management in improving the sustainability of SMEs by providing insights regarding performance management for long-term growth and viability in a competitive market. This study indicates that SMEs in HCMC can significantly improve their financial performance by adopting a comprehensive strategic management approach that integrates inside-out and outside-in perspectives with the mediating role of organizational creativity. Strategic management processes that cultivate a culture of creativity within SMEs are vital, as creativity profoundly influences the financial outcomes of business processes. Through a dedicated commitment to ongoing refinement and adaptation, SMEs can strategically leverage these insights to optimize their business operations, thereby enhancing their competitiveness in the market and facilitating sustainable growth in the current market. A workplace culture that nurtures creativity creates an environment where employees feel empowered to explore innovative ideas, take calculated risks and challenge conventional norms to enhance their business performance and sustainability in today's dynamic business landscape.

CONCLUSION

This research study collected samples from 411 Vietnamese SMEs in HCMC to analyze and present the results. The results indicated that the constructs in this research model have statistical acceptance. Factors such as the strategic management process, inside-out perspective, outside-in perspective, and the intermediary role of organizational creativity positively impact the financial performance of Vietnamese SMEs in Ho Chi Minh City. Creativity also plays a crucial role in enhancing financial efficiency because personnel working in a creative environment will not be constrained. SMEs can then develop skills, participate in strategic creativity, and encourage a passionate business ethic, all of which will contribute to their growth. If Vietnamese SMEs in HCMC pay attention to and take action on these issues, it will lead to changes and improvements in financial performance. Based on the information obtained, managers in HCMC can utilize this model as a means of auditing and reorganizing their companies to achieve non-financial results and, ultimately, improve financial performance. This approach will facilitate the survival and growth of Vietnamese SMEs, including in the prevailing competitive environment. Lastly, this research provides the basis for the academic community to develop and improve the theory of performance management, making a significant contribution to the field of performance management. The ideas provided by this research can be considered a significant resource for future academic research in this area.

Other scholars may find value in investigating the creative aspects of organizations, external and internal perspectives, strategic management, organizational creativity, and the financial viability of SMEs in HCMC. They may take this information and use it in their own investigations and even in practical business scenarios in their field. A corporation from a different country can deduce the research model's evidence by comprehending the effects of these components on financial performance. They can also explore ways to diversify their resources and maximize their effectiveness in various environments, all of which can ultimately lead to increased efficiency.

Limitations and future studies

This research has a number of limitations that are caused by the financial limitations and the research timeframe. Specifically, the investigation has a deficiency in categorizing Vietnamese SMEs in HCMC. Notably, it avoids categorizing these SMEs into different-sized classes; it instead provides general solutions to problems in all classes using a generalized approach. Additionally, the research fails to differentiate and categorize SMEs by their specific fields of business, such as specialization in production or services. This omission precludes a comparison of the differences between these different types of SMEs. In view of these limitations, future research endeavors could augment the research framework by systematically categorizing SMEs by their size and the specific industries they serve. This refinement would facilitate a more comprehensive comparative analysis and the formulation of precise solutions tailored to the unique characteristics of each type of enterprise.

Additionally, the age of the SMEs can significantly impact their operational effectiveness and financial performance. Older companies often take advantage of learned effects that augment their existing routines and abilities, and this has

a positive effect on their financial results. Conversely, younger companies have less experience and are typically subject to greater uncertainty, which can negatively affect their performance. As a result, future research could explore how SMEs' ability to learn can support their financial performance. Additionally, the age of the company is important in determining its growth and financial viability. Future studies could investigate the relationship between firm size and age in regard to strategic management and the effects of each on financial performance. This type of research can establish a comprehensive understanding and customizable solutions for new and veteran SMEs.

Finally, this research focuses on the strategic and managerial aspects of financial efficiency for SMEs. It has not examined other equally important factors for improving financial efficiency, such as the organizational culture and corporate social responsibility. Future research could expand to diversify the research variables and provide a broader and more diverse perspective.

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Biographical note

Vuong Khanh Tuan, PhD in Management, Malaysia University of Science and Technology (The Malaysia University of Science and Technology was established with the assistance of the Massachusetts Institute of Technology (MIT) under the auspices of a collaborative agreement between MUST-Ehsan Foundation of Malaysia and MIT). Currently, he is a lecturer in the Faculty of Marketing and International Business at HUTECH University.

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Vuong Khanh Tuan was responsible for all aspects of the study.

Conflicts of interest

The author declares no conflict of interest.

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Sustainability performance, corporate governance, and financial performance: Evidence from Poland and Central European listed companies

Joanna Błach¹ , Elżbieta Bukalska² 
Bogna Kaźmierska-Jóźwiak³ , Anita Radman Pesa⁴ 

Abstract

PURPOSE: Businesses are regarded as the main agents that can help achieve sustainable development. Therefore, more and more firms of various characteristics integrate sustainability issues into their business strategies. There is ongoing debate on the relationship between sustainability engagement and firm performance, with ambiguous results. Our study falls into this stream of research by adding the perspective of the Central European economy. The main objective of our paper is to examine the relationship between firm sustainability performance and its financial performance in the context of various corporate governance characteristics (in particular board attributes and ownership structure). **METHODOLOGY:** Our research sample covers firms listed on the Warsaw Stock Exchange representing various indexes (related to their size) and sectors in 2015–2021. We measure sustainability performance with our original aggregated index created by integrating key firm ESG engagement characteristics. Financial performance is analyzed from two different perspectives – accounting perspective illustrated by profitability of assets (ROA) and market perspective - illustrated by market value (MV/BV ratio). To achieve the research aims, several statistical methods were employed in the study, including selected descriptive statistics and panel regression models. **FINDINGS:** Our results confirm a significant positive relationship between sustainability and financial performance, as measured by ROA and MV/BV ratios. Additionally, we observe a significant positive relationship between gender diversity on the management board (the presence of women on the management board) and accounting performance. Our results provide an argument for firm engagement in sustainability initiatives, as it may improve its profitability and market value. **IMPLICATIONS for theory and practice:** Our study not only contributes to the corporate finance and sustainability literature by providing evidence on the relationship between sustainability performance and financial performance in the context of the Central European economy, but also provides insights for corporate governance research in terms of boards attributes and different types of ownership structures. The policy suggestions derived from our findings can benefit both managers and regulators, focusing on the sustainable development paradigm and ultimately enhancing overall stakeholder well-being. **ORIGINALITY AND VALUE:** The originality of our research stems from investigating the relationship between sustainability performance and firm performance from both an accounting and a market perspective and using the original sustainability index developed for the purpose of the study. Additionally, we address potential gaps in existing research by incorporating several corporate governance characteristics to clarify their importance for a firm performance. **Keywords:** sustainability performance, firm performance, ownership structure, board attributes, corporate governance, listed companies, ESG performance, financial performance

1 Joanna Błach, Associate Professor, University of Economics in Katowice, Faculty of Finance, 1 Maja 50, 40-287 Katowice, Poland, e-mail: joanna.blach@uekat.pl (ORCID ID 0000-0002-6546-2172).
2 Elżbieta Bukalska, Associate Professor, Maria Curie – Skłodowska University in Lublin, Faculty of Economics, Pl. M. C. Skłodowskiej 5, 20-031 Lublin, Poland, e-mail: elzbieta.bukalska@mail.umcs.pl (ORCID: <https://orcid.org/0000-0001-8097-5964>).
3 Bogna Kaźmierska-Jóźwiak, Associate Professor, University of Lodz, Faculty of Management, J. Matejki 22/26; 90-237 Łódź, Poland, e-mail: bogna.kazmierska@uni.lodz.pl (ORCID: <https://orcid.org/0000-0002-1692-7682>).
4 Anita Radman Pesa, Ph.D., Professor and Researcher at Department of Economics, University of Zadar, Department of Economics, Splitska 1, 23000 Zadar, Croatia, e-mail: apesa@unizd.hr (ORCID ID 0000-0003-3767-0676).

INTRODUCTION

In recent years, the concept of sustainability has been promoted extensively by authorities in the European Union (EU) or the United Nations (UN). Enterprises are encouraged to integrate social, environmental, corporate governance, ethical, and human rights concerns into their business strategy and operations. This shift towards sustainability fundamentally changes the way the companies are managed, with sustainability goals being added to the economic goals and integrated into business strategy. However, many companies consider sustainability activities as costly ones. Apart from the legal obligation to implement sustainability in everyday operations, there should be incentives for companies to include sustainability recommendations in the business. These may include the positive impact of sustainability performance on enhancing resources management efficiency, strengthening competitive position, improved financial results, and positive reactions from the financial market. Consequently, companies are interested in sustainable activities, provided they prove beneficial.

According to the recent literature review by Rahi et al. (2023), the debate on the link between sustainability performance and financial performance remains unresolved. Moreover, they argue that contemporary research in this field lacks a comprehensive framework. Additionally, they observe that the nexus between sustainability and firm performance depends on the country-level sustainability. Motivated by these conclusions, we try to address these issues in our research by focusing on the relationship between sustainability performance and firm financial performance in the Polish context.

Extant research provides inconsistent evidence on sustainability adoption on the firm performance (Lindgreen et al., 2009; Lassala et al., 2017; Lassala et al., 2021; Rahi et al., 2023). Despite the increased implementation of sustainable issues around the world, there is still a disagreement on the link between sustainability and financial performance, which is represented by the proponents of the neutral, positive or negative approach. The main controversies arise from the fact that sustainability initiatives may increase costs and impact financial performance in the short term, while the potential benefits of these actions may only be seen in the long term. Other concerns include the diversity of regulations and reporting frameworks for sustainability across countries, varying opinions and expectations among shareholders and other stakeholders, which may be country-specific, as well as the existence of greenwashing practices. The lack of a consensus on this relationship motivates the authors to further explore this issue in the context of one of the European Central economies.

In this study, firm performance is analyzed through two distinct lenses: the accounting approach and the shareholders theory approach (Friedman, 2007). The first approach is focused on the accounting profit and a firm's profitability as measured by return on assets (ROA), while the second approach examines market performance as measured by market to book value (MV/BV). These two different approaches enable us to examine the relationship between firm financial performance and sustainability performance in two separate dimensions. The rationale behind this approach stems from the statements of Gentry and Shen (2010), who argued that measures of accounting profitability and market performance represent distinct dimensions of firm performance and should not be used interchangeably. ROA, a classic efficiency metric, computed as net profit over total assets, aligns with the neoclassical theory of corporate finance (Van Der Laan et al., 2007) and stresses the importance of generating accounting profit. This measure of financial performance is commonly used in empirical studies due to its simplicity and comparability. However, its application requires accepting the limitation of the accounting profit used as a measure of a firm's financial performance, such as short-term focus, ignoring cash flow and risk, or being affected by accounting and tax policies. To overcome these limits, the second approach is used based on MV/BV ratio as the financial performance measure, illustrating shareholder value maximization objective. Therefore, the market to book value represents the sentiment of investors and the way they perceive the value of the company and its future growth. However, when using market performance measures, one has to accept that a firm's stock price may not reflect its fundamental value due to financial market imperfections and limited market efficiency. Despite these considerations, financial performance ratios are widely used in both theoretical studies and empirical research. Researchers typically regard accounting ratios as measures of past or short-term financial performance, while market ratios are seen as proxies for future or long-term performance (Gentry & Shen, 2010). This duality allows for comprehensive analysis of firm financial performance from different perspectives.

The second element - corporate sustainability performance encompasses the ability of a company to positively influence environmental, social, and economic development through its governance practices and market presence (Krechovská & Procházková, 2014; Marco-Lajara et al., 2023). Within this framework, the business case for sustainability emerges as the strategic attempt by companies to balance social, economic, and environmental objectives. By integrating

sustainable development goals into the corporate strategy, companies aim not only to achieve long-term success but also contribute meaningfully to sustainable development (Marco-Lajara et al., 2023). There is no single, universal approach to measuring sustainability performance. As presented in the literature, corporate sustainability performance can be measured using various indicators and models (Dočekalová & Kocmanová, 2016; Jiang et al., 2018; Nikolaou et al., 2019; or Matuszewska-Pierzynka et al., 2023). This lack of standard metrics makes it difficult to examine the importance of sustainability performance and compare results for different companies.

This study differs from previous research in three key aspects. Firstly, various studies have used different measurement scales for specific aspects of sustainability (Dočekalová & Kocmanová, 2016; Jiang et al., 2018; Nikolaou et al., 2019). This diversity may lead to discrepancies and affect the perceived link between sustainability and financial performance. To effectively integrate various aspects of sustainability, this study introduces our own measure - the aggregated index of sustainability performance. Additionally, the originality of our research stems from investigating the relationship between sustainability performance and firm performance in two distinct dimensions - from both market and accounting perspectives. Most of the existing research refers solely to either market or accounting performance measures, missing the benefits of applying multiple perspectives. Finally, we address potential gaps in existing research by incorporating several corporate governance characteristics to clarify the relationship between sustainability and firm performance. We believe that corporate governance characteristics, including management board attributes (in particular, board size and board diversity) and different types of ownership structures (in this, family, state, managerial, or institutional investor ownership), may either facilitate or hinder the implementation of sustainability concepts in the business strategy and thereby help explain the relationship between sustainability performance and firm performance.

Based on the literature, three research hypotheses are formulated to evaluate the relationship between sustainability performance and firm performance (H1), the size of the management board and firm performance (H2), the gender diversity of the management board and firm performance (H3), ownership concentration and firm performance (H4), and the type of ownership structure and firm performance (H5). The nature of the data allows us to use panel data analysis. We focus on companies listed on the Warsaw Stock Exchange across three indices: WIG20, mWIG40, and sWIG80. The study examines data over the period 2015-2021. The final sample covers 93 companies with 651 firm-year observations. The data were retrieved from Notoria Service, the EMIS database, the economic service of the Polish Press Agency, as well as information sourced directly from companies' websites and corporate reports.

Our research is conducted in the specific context of Polish companies, following the suggestions of Xiao et al. (2018) and Rahmi et al. (2023), who stated that corporate sustainability performance depends on country-level sustainability. They also emphasized that stakeholder expectations related to sustainability are influenced by the unique characteristics of each country. Poland is the largest economy in Central Eastern Europe with a well-developed financial market. By focusing on Polish companies, we aim to set a benchmark for further research and actions on implementing sustainability in Central Eastern European countries. Despite Poland's economic significance, there is a paucity of research on Polish companies and the relationship between sustainability performance and firm performance. One stream of existing research on Polish companies refers to the review of sustainability (alternatively CSR/SDG) practices implemented by Polish companies (Dyduch & Krasodomska, 2017; Garstecki et al., 2019; Witek-Crabb, 2019), their impact on financial results (Witek-Crabb, 2018; Daszyńska-Żygadło, 2019) or societal factors behind sustainable entrepreneurship orientation (Doś & Pattarin, 2024). There are some studies for the specific sectors: the energy sector (Zieliński & Jonek-Kowalska, 2021; Stuss et al., 2021), industry (Daszyńska-Żygadło, et al., 2020), banking (Pyka & Nocoń, 2024; Daszyńska-Żygadło et al., 2020; Matuszak & Różańska, 2017; Matuszak et al., 2019) or ESG funds (Dmuchowski et al., 2023). Finally, much research has been devoted to sustainability (CSR/ESG) reporting - its content, quality and assurance (Krasodomska et al., 2022; Klimczak et al., 2023; Krasodomska et al., 2023; Hąbek, 2014).

To our knowledge, our study is the first to investigate the relationship between sustainability performance and firm performance (both illustrated by market and accounting ratios) using our own developed measure of sustainability performance integrating various aspects of sustainability actions across a broad sample of Polish companies.

Our findings not only contribute to the corporate finance and sustainability literature, but also provide insights for corporate governance research, as we add the perspective of various board attributes and ownership structures to our study. The policy suggestions derived from our findings can benefit managers and regulators, ultimately enhancing overall stakeholder well-being.

The remainder of this paper is organized as follows. The next section briefly discusses the theoretical background of the study, reviews existing literature, and develops hypotheses. Subsequently, we present the data, variables, and research

methodology. Following this, we discuss the empirical results and their interpretation. Finally, we present the theoretical and practical implications of the study. The paper concludes with recommendations regarding future research agendas.

LITERATURE REVIEW

The major objective of our study is to assess the relationship between sustainability performance and financial performance. The current literature regarding this relationship provides mixed evidence from different perspectives: 1) neutral approach – proposing a neutral stance, suggesting that there is no relationship between sustainability performance and financial performance (Aras et al., 2018; Witek-Crabb, 2018); positive approach – indicating that sustainability performance can improve financial performance, aligning with the social impact hypothesis and reputation-building explanation (Waddock & Graves, 1997; Margolis et al., 2009; Fernando et al., 2017; Daszyńska-Żygadło, 2019; Matuszewska-Pierzynka, 2021); and negative approach – suggesting that sustainability performance may worsen financial performance, in line with the substitution hypothesis (García-Castro et al., 2009; Vogel, 2006).

Moreover, the direction of impact is also debatable. It is unclear whether improvements in financial performance result from sustainable actions, as proposed by the social impact hypothesis, or whether financial results drive firm's engagement in sustainable practice, as suggested by the hypothesis of availability of funds for sustainable actions, which is linked to the slack resources theory. This ongoing debate underlines the complexity of this relationship and justifies further research in this field.

Numerous studies have examined the relationship between corporate financial performance and sustainability performance (often referred to as Corporate Social Responsibility, CSR or more recently - Environmental, Social and Governance, ESG performance). However, as evidenced by Rahi et al. (2023) in the recent literature review, the debate on the link between sustainability performance and financial performance is not solved. According to Makni et al. (2009), financial performance levels can be changed in response to changes in sustainability performance. This is in line with Freeman's (1984) stakeholder theory, stating that integrating corporate social responsibility in the firm strategy allows companies to meet stakeholders' needs and improve their reputation, consequently leading to better financial results. In empirical studies, Matuszewska-Pierzynka (2021) confirmed that the improvement in economic, environmental, and social sustainability performance leads to an increase in operating performance in terms of total revenues. Gonçalves et al. (2023) found a strong positive association between sustainability and economic performance in European firms, particularly driven by the environmental pillar. This positive relationship between sustainability performance and firm performance is explained by the synergic effect hypothesis (Ma & Latif, 2023). On the other hand, an inverse relationship between CSR levels and financial performance has also been proposed (García-Castro et al., 2009), as some researchers argue that a firm's sole social responsibility is profit maximization. CSR initiatives, in this view, represent unnecessary expenses that can lower firm financial performance relative to its competitors (Friedman, 2007). It is also suggested that the relationship between sustainability and financial performance varies across different sectors (Şerban et al., 2023) and for companies of different sizes (Abughniem et al., 2019; Kılıç et al., 2022).

Several studies found a positive relationship between sustainability (or ESG performance) and profitability measured by the return on assets (ROA) ratio (Velte, 2017; Bodhanwala & Bodhanwala, 2018; Bassetti et al., 2020; Pham et al., 2021; Kılıç et al., 2022). However, in a study by Velte (2017), this association was not found for a market performance, as measured by Tobin's Q. Moreover, through analysis of the three distinct components of ESG, it was confirmed that governance (G) performance exhibits the strongest influence on financial performance when compared to environmental (E) and social (S) performance. Han et al. (2016) observed that ESG disclosure scores, used as a proxy for ESG performance in Korean corporations, provided diversified results concerning corporate financial performance, as measured by Return on Equity (ROE), Market-to-Book Ratio (MV/BV) and Stock Return. Several studies demonstrated a positive direct relationship between sustainability performance and market performance, as measured by MV/BV ratio (Lourenço et al., 2013; Maso et al., 2023), whereas Aras et al., (2018) and (Kılıç et al., 2022) found insignificant results when examining the link between sustainability performance and market value. The positive association between the sustainability performance and market value is linked to firm reputation as sustainable companies are recognized for their commitment, attracting more investors in the capital market and consequently, achieving a higher price to book value ratio (Buallay, 2019; Maso et al., 2023).

Therefore, the debate remains open due to inconclusive or mixed findings (Lindgreen et al., 2009; Lassala et al., 2017; Lassala et al., 2021; Rahmi et al., 2023). Several factors contribute to this discrepancy, including variations in applied models (Al-Tuwaijri et al., 2004), number of sustainability standards adopted by firms (Darnall et al., 2023), differences

in definitions and variables used to measure financial performance and sustainability, sample characteristics (Waddock & Graves, 1997) including country-specific factors, and the absence of control variables as size and economic sector (Abughniem et al., 2019; Lassala et al., 2021).

Based on this discussion presented in the extant literature, we have chosen to adopt a positive approach and have consequently formulated our primary hypothesis regarding the relationship between sustainability performance and financial performance in terms of accounting (ROA) and market performance (MV/BV).

H1a: There is a positive relationship between sustainability performance and ROA.

H1b: There is a positive relationship between sustainability performance and MV/BV.

Additionally, in our study, we aim to address the selected corporate governance mechanisms (in particular, management board characteristics and ownership structures) as the factors moderating the relationship between sustainability performance and financial performance. This part of research is designed to detect if corporate governance factors are important determinants of financial performance for companies of diverse sustainability performance. In particular, we focus on the characteristics of management boards, as this internal corporate governance mechanism has a strong impact on firms' efficiency. Extant studies suggest that strong corporate governance leads to higher sustainability performance contributing to financial performance and firm value (Lu, 2020; Pham et al., 2021; Nguyen, 2022; Wang et al., 2023).

The relationship between board characteristics and firm performance is indeed complex and multidimensional, often explored through the lenses of agency theory (Jensen & Meckling, 1976). Within this research stream, various board characteristics are explored, including the composition of the board, board independence, the presence of board committees, and board size. Due to their explanatory power and data availability, our study is concentrated on two specific characteristics: board size and board gender diversity. The structure and activity of the board represent key internal mechanisms of corporate governance, providing tools and methods for managing and controlling firm performance effectively from the perspective of its owners and other stakeholders. Such internal mechanisms play an essential role in the continental corporate governance system typical for Polish companies. The first board characteristic that may have an impact on firm performance is board size, however the extant literature provides mixed evidence. On one hand, many studies confirmed a negative relationship between board size and firm performance (Guest, 2009; O'Connell & Cramer, 2010; Augusto et al., 2019). A study by Guest (2009) for UK listed firms spanning from 1981 to 2002 found that board size has a strong negative impact on firm profitability and market performance. It also suggested that such a relationship is due to poor communication and lower effectiveness of large boards. O'Connell and Cramer (2010) received similar results in Ireland context - they observed that board size exhibits a strong negative association with firm performance. Similarly, in the context of emerging economies, Alabdullah et al. (2021) proved that there is a negative relationship between size of the board and profitability. On the other hand, Larmou and Vafeas (2010) found that an increase in the board size leads to an increase in the share market price, therefore, it is positively related to shareholder value. The same positive relationship between board size and firm performance (both in terms of accounting and market performance) was found by Pucheta-Martínez and Gallego-Álvarez (2019) covering over 10,000 firm-years observations from 34 countries across six geographic zones. The positive association between board size and firm performance with regard to its market value was confirmed for West African companies in study by Tuo et al. (2021). However, Rodríguez-Fernández et al. (2014), who studied Spanish companies, suggested that there is no clear relationship between board size and firm performance. Finally, Neves et al. (2022) suggested that non-financial French firms should have the optimal number of board members for achieving good performance.

As indicated above, research on the relationship between board size and firm performance indeed provides mixed results. These inconsistencies arise from the diverse types and functions of boards under examination, such as management boards or supervisory boards in a two-tier corporate governance system, or the board of directors in a one-tier corporate governance system. Additionally, variations in the measures of firm performance used across studies contribute to these unequivocal findings. Based on these diverse observations, we formulate hypotheses regarding the relationship between the size of management board and firm performance without specifying the nature of this relationship:

H2a: There is a significant relationship between the size of the management board and ROA.

H2b: There is a significant relationship between the size of the management board and MV/BV.

The second board characteristic examined in this study is board gender diversity, which is associated with the potential for more comprehensive and balanced decision-making, as well as enhanced transparency, accountability, and ethical behavior. In our study, we aim to examine if Polish companies are adapting to the social changes related to the increased participation of women in the workforce and if they are using the opportunity to enhance their performance through more inclusive leadership practices. Numerous studies have explored the impact of board gender diversity on firm performance. Similarly, in this context, empirical results are varied and inconclusive, further motivating our research.

Pucheta-Martínez and Gallego-Álvarez (2019) found that having a female director is positively linked to firm performance. Green and Homroy (2018) studied large European firms and provided robust evidence of the positive effect of female board representation on firm performance. They also found that female representation on board committees is positively related to firm performance. In the context of developing countries, the positive significant effect of female board representation on firm performance was also observed in West African companies (Tuo et al., 2021). Similarly, Li and Chen (2018) found that the board gender diversity has a positive impact on firm performance, but this relationship is observed for the companies of relatively smaller size in case of the analyzed Chinese listed companies. They also provided evidence that firm size may undermine the positive impact of board gender diversity on firm performance. Brahma et al. (2021) stated that gender diversity positively and significantly impacts financial performance (ROA and Tobin's Q), especially when three or more women serve on the board of firms compared to firms with lower levels of representation in the UK context. It is suggested that gender diversity leads to better decision-making processes, different attitudes toward risk and diversified skills, which may positively influence firm performance (Hassan et al., 2016; Moreno-Gómez et al., 2018; Pidani et al., 2020).

In contrast to these findings, Gruszczyński (2020) observed no significant correlation between female representation on corporate boards and firm performance in the context of large European companies. Similarly, Marinova et al. (2016) did not confirm the definitive link between board diversity and firm performance as measured by Tobin's Q across Dutch and Danish companies. Finally, Darmadi (2013) found a negative relationship between female representation and ROA in the Indonesian context.

Variations in results for the relationship between board gender diversity and firm performance have similar reasons as in the case of a link between board size and firm performance. Therefore, this issue remains open for discussion. As proponents of the positive approach, we formulate the following hypothesis in our study to contribute to this ongoing discussion:

H3a: There is a positive relationship between gender diversity of the management board and ROA.

H3b: There is a positive relationship between gender diversity of the management board and MV/BV.

As previously indicated, the second group of corporate governance factors pertains to ownership structure. Building upon existing research (e.g., Zandi et al., 2020; Bhakar et al., 2024), our study underscores the importance of ownership structure for the decision-making process, defining strategic objectives, formulating sustainability strategy, consequently shaping financial results and impacting market valuation. We recognize the role of firm owners in effective management decisions and in reducing conflict of interest between managers and shareholders, facilitated by the supervisory board's monitoring activity. Consequently, we assume in our study that ownership structure may influence firm performance, in terms of both accounting profitability and market value.

Research on the relationship between ownership structure and firm performance dates back to the seminal work of Berle and Means (1932), who found that in widely held corporations in the U.S. (with ownership dispersed among small shareholders and control), control tends to be concentrated in the hands of insiders, leading to underperformance. Ownership concentration serves as an internal mechanism within corporate governance, influencing the control delegated to management and owners (Neves et al., 2023). Based on these findings, Jensen and Meckling (1976) developed the owner-manager agency problem, stating that separation of ownership and control leads to potential agency conflicts. Later, Shleifer, and Vishny (1986) suggested that large external equity holders can mitigate agency conflicts through effective monitoring and management discipline. Following these statements, we focus first on the relationship between ownership concentration and financial performance. However, the literature demonstrates that the impact of ownership concentration on firm performance ranges from positive to negative outcomes.

Mak and Kusnadi (2005) indicated that there is a positive relationship between block-holders' (large) ownership and firm performance (as measured by the Tobin Q ratio) in the context of Malaysia and Singapore. Similarly, Young et al.

(2008) reported that firm performance (Tobin Q) is positively related to block holders' ownership in Taiwan. Bhakar et al. (2024) confirmed the same positive relationship in a literature review study covering works from 1977 to 2022.

In contrast, contradictory evidence was presented in the works of Demsetz and Villalonga (2001), suggesting that higher ownership concentration leads to lower firm performance (Tobin Q) in the US context. Villalonga and Amit (2006) found out that block-holders' ownership is negatively associated with firm performance (Tobin Q) in a sample of 508 firms listed on the Fortune 500 spanning from 1994 to 2000. Similarly, Pekovic and Vogt (2021) found a negative relationship between ownership concentration and firm performance. Moreover, Paniagua et al. (2018) documented the negative relationship between ownership dispersion and firm performance (measured by Return on Equity, ROE) in their study, covering a diverse sample of 1207 companies from 59 countries. Laporšek et al. (2021) confirmed that Slovenian state-owned companies exhibit lower profitability compared to privately-owned counterparts. However, their study did not confirm a statistically significant relationship between ownership concentration and firm performance.

Despite the mixed empirical evidence, the agency theory posits that shareholders with large stakes in a corporation can effectively monitor management. Therefore, we may expect higher ownership concentration to be associated with better firm performance. The above argument suggests the following hypothesis:

H4a: There is a positive relationship between the ownership concentration and ROA.

H4b There is a positive relationship between the ownership concentration and MV/BV.

Given the inconsistent findings regarding the relationship between ownership concentration and firm performance, we decide to focus further research on the impact of different types of controlling owners: managers, family, institutional investors, and state ownership. These various types of owners have different investment objectives, influencing their relations with the companies they invest in. They may also differ in their opinions about the importance of a firm's engagement in sustainability initiatives, which may impact a firm's financial and sustainability performance.

Managerial ownership, as suggested by Jensen and Meckling (1976) on the grounds of the agency theory, can potentially reduce managerial incentives to consume perquisites, expropriate shareholders' wealth, or engage in other sub-optimal activities and consequently align the interests of managers and shareholders, lowering agency costs and leading to improved firm performance. In line with this notion, Coles et al. (2012) found a positive association between managerial ownership and firm performance (Tobin Q) in their analysis of data from the Execucomp database from 1993 to 2000. Similarly, Singh and Davidson (2003) observed a positive impact of managerial ownership on asset management efficiency (measured by total assets turnover) among large US companies. The same positive relationship was observed by Zandi et al. (2020) in a study covering 200 Malaysian listed companies. In contrast, scholars such as Demsetz (1983) and Fama and Jensen (1983a & b) pointed out that increasing insider ownership stakes might foster adverse entrenchment effects, potentially leading to intensified managerial opportunism at the expense of external investors.

Family firms are a special class of large shareholders with unique incentive structures. For example, concerns regarding family and business reputation and firm survival would tend to mitigate the agency costs of external debt and external equity (Demsetz & Lehn, 1985; Anderson et al., 2003), although controlling family shareholders may still expropriate minority shareholders (Claessens et al., 2002; Villalonga & Amit, 2006). Several studies (e.g., Anderson & Reeb, 2003; Villalonga & Amit, 2006; King & Santor, 2008) reported that family firms, particularly those with large personal ownership, tend to outperform non-family firms (in terms of both profitability and Tobin Q). In addition, the empirical findings presented by Maury (2006) suggest that large controlling family ownership in Western Europe is associated with beneficial effects on minority shareholders in terms of profitability.

Institutional investors, managing diversified portfolios on behalf of their clients, are characterized by their expertise and active involvement in firm management. Compared to individual investors, institutional investors are more skillful and sophisticated – thus they are called better-informed investors (Li et al., 2017). The presence of institutional investors among company shareholders has been studied in terms of their impact on many aspects of corporate finance (Ferreira & Matos, 2008). Particularly, the positive impact of institutional investors has been confirmed on firm performance – both in terms of accounting and market performance. Institutional investors may motivate management effectively, as they have the necessary resources and ability to monitor, discipline, and influence managers (Cornett et al., 2007; Callen & Fang, 2013). Thus, several studies have proven a positive relationship between institutional ownership and firm performance, both in terms of profitability (Cornett et al., 2007; Elyasiani & Jia, 2010) and in terms of market value (measured by Tobin Q) (Buchanan et al., 2018; Arora & Sharma, 2016).

State ownership introduces a distinct set of firm objectives, including social and political goals (e.g., Hellman & Schankerman, 2000), which may diverge from profit-driven motives. These functions and objectives may encourage government agencies to intervene in business activities. The State might want the company to implement investment projects even if they are not profitable enough, particularly in the case of multi-generation projects. The State's intended role is to ensure public security in critical sectors (energy, transportation, telecommunication services, and broadcasting). This might lead to a lower financial firm performance of SOEs (State-Owned Enterprises) (Kabaciński et al., 2020; Chong & Zhang, 2022).

There are several studies on the firm performance of SOEs (e.g., Eforis & Uang, 2015; Szarzec & Nowara, 2017; Matuszak & Szarzec, 2019). Despite the common perception that State ownership is connected with lower firm performance, the results of existing studies show mixed results. Eforis and Uang (2015) found that state ownership is positively related to firm performance, demonstrating that governmental support in developing countries is beneficial to firm growth. Szarzec and Nowara (2017) observed that economic performance of state-owned companies is, on average, comparable to their private counterparts. However, Matuszak and Szarzec (2019) reported lower performance among state-owned enterprises. Additionally, studies such as Berger et al. (2005) have linked associate state ownership and state governance with inefficiencies and poor performance in Argentina context.

Given these diverse findings, it is evident that the type of ownership structure significantly influences firm performance. Further research is needed to understand the relationship between the type of ownership and firm results in this accounting and market performance. Based on this rationale, we propose the following hypothesis:

H5a: There is a significant relationship between the type of ownership structure and ROA.

H5b: There is a significant relationship between the type of ownership structure and MV/BV.

METHODOLOGY

Research method and sample

The research aims to explore the relationship between corporate sustainability performance and corporate financial performance. Additionally, in our study, we aim to address the selected corporate governance mechanisms (board characteristics and ownership structures) as the factors determining the financial performance for companies of diverse sustainability performance. To achieve this, the study employs several statistical methods, including selected descriptive statistics and panel regression models. The research design is presented in Figure 1.

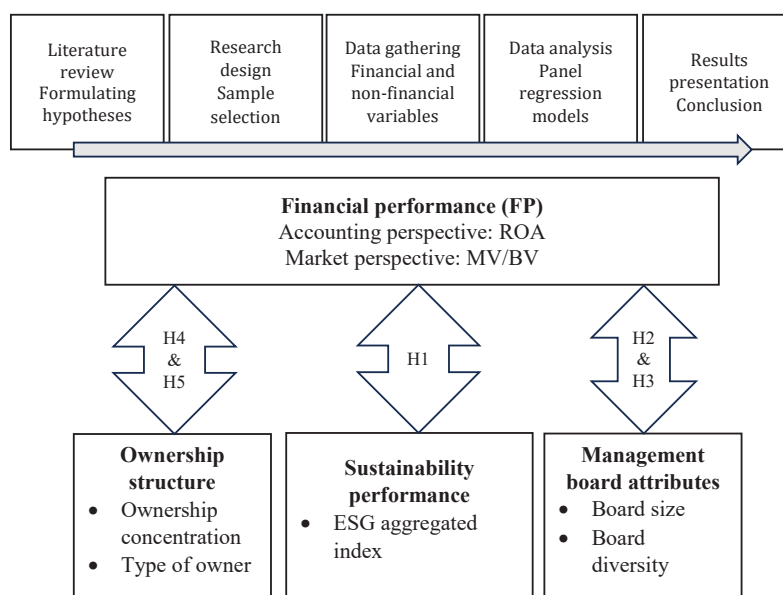


Figure 1. Research design

Focusing on companies listed on the Warsaw Stock Exchange across three indices: WIG20 (20 large companies), mWIG40 (40 medium companies), and sWIG80 (80 small companies), the study examines data spanning from 2015 to 2021. Initially, 140 companies were included in these indices (as of December 31, 2022). However, exclusions were necessary for firms in the financial sector (such as banks and insurers), foreign companies operating outside Poland, or firms with missing information (in this, companies that were not included in these indices for the entire 2015-2021 period). Consequently, the final sample covers 93 companies with 651 firm-year observations (16 companies coming from WIG20, 23 - from mWIG40, and 54 - from sWIG80). The research sample comprises: 44 companies from the manufacturing sector, 22 from the service sector, 11 from the construction sector, 13 from the trade sector, and 3 from the mining sector. Data collection process involved using Notoria Service for primary financial and corporate governance data. In addition, the annual reports of the companies for the years 2015-2021 were analysed using the EMIS database, the economic service of the Polish Press Agency, as well as information sourced directly from companies' websites and corporate reports. The nature of data allows the use of panel regression models to test the research hypotheses. The general form of the panel regression model can be expressed as follows (Gruszczynski et al., 2012, p. 271):

$$Y_{it} = \alpha_i + \beta X_{it} + \varepsilon_{it} \quad (1)$$

where:

- Y_{it} represents the endogenous variable, in our study there are two endogenous variables that represent operating performance measured by ROA (return on assets) and market performance measured by MV/BV (market value to book value);
- α_i – intercept term;
- β – row vector of slope coefficient of regressors;
- X_{it} - exogenous variables described in Table 1;
- ε_{it} - error term.

The period 2015-2021 was chosen for analysis for several reasons. Primarily, in 2015 the United Nations adopted the Sustainable Development Goals (SDGs), a global initiative aiming at ending poverty, protecting the planet, and ensuring peace and prosperity by 2030. Moreover, numerous law regulations were introduced at both the European Union and national levels to promote sustainability and corporate responsibility. Key regulations include the adoption of the Non-financial reporting Directive (NFRD) in October 2014, and the proposal for a Corporate Sustainability Reporting Directive (CSRD) in April 2021. At the national level, the most important regulations included the adoption of the Energy of Poland until 2040 (2021), The 2030 National Environmental Policy (2019), and The Strategy for Responsible Development for the period up to 2020 (with a perspective up to 2030). Therefore, a strong regulatory framework requires adequate responses from businesses.

Throughout this period, there has been an increasing global focus on sustainability issues, encompassing environmental protection, social responsibility, and corporate governance. Various corporate stakeholders are becoming more aware of the imperatives of sustainability and the obligations corresponding to society. This leads to bottom-up pressures on managers to prioritize sustainability performance to drive long-term corporate value. Poland was selected as the country setting for examining the nexus between sustainable and financial performance due to its leading economy position in Central and Eastern Europe, and successful transition from a command to a free-market economy. This experience may become useful today, when Poland is facing other challenges in sustainable development, energy transition, climate change, social inequalities, and the circular economy. Thus, studying the sustainability practices and reporting mechanisms of Polish firms may provide interesting insights into the evolving landscape of ESG transformation across Central European companies.

Moreover, the Warsaw Stock Exchange offers trading in stock of companies from various sectors, industries, ownership structures, and corporate governance practices. This diversity facilitates comprehensive observations and comparisons of ESG practices, sustainable performance metrics, and financial performance.

Variables included in the empirical analysis

To ascertain the relationship between sustainability performance and firm performance, several variables were applied in line with extant research in this field. Understanding the limitations of each indicator, the corporate financial performance

was measured alternatively: Return on Assets (*ROA*) as an accounting measure and market-to-book value (*MV/BV*) as a market performance ratio. As explained in the introduction, this approach aligns with the suggestion of Gentry and Shen (2010), who stated that accounting profitability and market performance represent distinct dimensions of firm performance. This perspective allows for a more comprehensive analysis of the relationship between sustainability performance and financial performance. *ROA*, calculated as net profit over total assets, can be considered as the traditional efficiency measure (Van Der Laan et al., 2007), while the *MV/BV* ratio illustrates the shareholder value maximization objective. *ROA* values were calculated based on financial accounting data retrieved from Notoria Service, while *MV/BV* values were calculated using stock market prices from the Warsaw Stock Exchange at the end of each fiscal year. Our approach is consistent with several studies examining the relationship between firm performance and sustainability performance in various contexts (Lourenço et al., 2013; Velte, 2017; Bodhanwala & Bodhanwala, 2018; Bassetti et al., 2020; Pham et al., 2021, Maso et al., 2023).

A range of indicators and metrics are used to assess the corporate sustainability performance, focusing on particular aspects of sustainability actions, as evidenced in studies by Dočekalová and Kocmanová (2016), Jiang et al. (2018), Nikolaou et al. (2019), Daszyńska-Żygadło (2019) and Matuszewska-Pierzynka et al. (2023). This variety may lead to discrepancies and affect the perceived link between sustainability and financial performance. To effectively integrate various aspects of sustainability, this study introduces our own measure - the ESG aggregated index of sustainability performance (*ESGaggr*). The original index is constructed as a composite of five elements, illustrating the multi-dimensional nature of firm sustainability performance. When constructing the ESG aggregated index, we use five variables, assuming that each is equally important for the sustainability performance. We computed the overall mean across these five factors, following the methodology used by Van Der Laan et al. (2007). These elements include two factors related to external assessment of ESG firm performance, ensuring its objectivity (*WIG_ESG* and ESG risk rating), and three factors related to a firm's internal decisions: the applied sustainability reporting practices (GRI standard and ESG report) and sustainability management practices, along with a strategic approach to ESG issues represented by appointing a board member for the sustainability issues (ESG board member). Therefore, the ESG aggregated index is derived from five key components, each assigned a binary value:

- *WIG_ESG* - takes 1, if firm is listed within the ESG index on the Warsaw Stock Exchange (in each year), 0 – otherwise;
- ESG risk rating - takes 1, if firm has got the ESG risk rating assigned by the Sustainability (at least once during the analyzed period), 0 – otherwise;
- GRI standard - takes 1, if firm uses the GRI standard for the sustainability reporting (in each year), 0 – otherwise;
- ESG report - takes 1, if firm has got a separate sustainability/ESG/CSR/non-financial report (in each year), 0 – otherwise;
- ESG board member - takes 1, if firm appoints a board member responsible for the sustainability/ESG/CSR actions or strategy (in each year), 0 - otherwise.

Therefore, the ESG aggregated index spans from 0 to 1, illustrating the breadth of coverage across these five elements of sustainability performance. A score of 0 suggests a lack of observations related to sustainability performance, while a score of 1 indicates comprehensive coverage across all components. We decided to build our own ESG aggregated index for several reasons. Firstly, to cover various aspects of sustainability performance, comprising both the internal dimension: strategic approach and reporting practices, and the external assessment: ESG risk ratings and inclusion in the ESG index. Secondly, we use the composite index to encompass a broad spectrum of companies in our study, as many Polish companies are either not included in the ESG index or are not evaluated through ESG risk ratings.

Understanding the importance of corporate governance mechanisms as the factors moderating the relationship between sustainability performance and financial performance, we use variables illustrating the board attributes in our study. In particular, we focus on the management board characteristics, as this internal corporate governance mechanism has a strong impact on firm efficiency and firm performance (Lu, 2020; Pham et al., 2021; Nguyen, 2022; Wang et al., 2023).

Following extant literature, we decide to focus on two management board characteristics, which are presented with two variables retrieved from the Notoria database:

- the size of the board – measured by the natural logarithm of the number of board members (*LnBoard*) (Augusto et al., 2019; Alabdullah et al., 2021; Neves et al., 2022);

- the presence of women on the board – measured as the number of women on board to the total number of board members (*Board_W*) (Hassan et al., 2016; Moreno-Gómez et al., 2018; Pidani et al., 2020).

The second group of corporate governance mechanisms related to ownership characteristics are illustrated through various variables, each shedding light on different aspects of ownership structure. These variables describe the importance of specific types of owners (financial, state, managerial, family owners), and provide information on ownership concentration. The family firm indicator (*FAM_own*) is a binary variable, denoting whether a firm is family-owned (1) or not (0) retrieved from the Warsaw Stock Exchange. Additionally, for other types of ownership structures, we use the percentage of total shares held by specific owners, including the state (*STATE_OWN*), financial investor (*FIN_OWN*) or the CEO (*MAN_OWN*). Ownership concentration is captured through two proxies, following the approach used by Horobeț et al. (2019) in a study on ownership concentration in the European Union. The first ratio illustrates the percentage of total shares held by the primary dominant shareholder (*OWN_1*), while the second one represents the percentage of total shares held collectively by the top three major shareholders (*OWN_3*). These measures provide insight into the level of control exerted by majority shareholders.

We also include in our research several control variables presenting the specificity of the company: firm size, market maturity, leverage, and tangibility. The size of a firm has been found to have a significant influence on the relationship between sustainability performance and financial performance, with varying effects observed in different sectors and countries (Abughniem et al., 2019; Kılıç et al., 2022). In our model, we employ the natural logarithm of total assets as a proxy for firm size (*SIZE*) following earlier studies (Yadav et al. 2021). While many studies examine the relationship between firm size and profitability, the results remain inconclusive. Some studies confirm the positive relationship between firm size and profitability (Doğan, 2013 and Işık et al., 2017 for Turkish firms; and Rahman & Yilun, 2021 for Chinese companies, Yoon & Jang, 2005 for restaurants, Kędzior & Kędzior 2023, for Polish SMEs in the service industry, and Ziolo et al. 2023, for 11 EU countries). However, Becker-Blease et al. (2010) discovered both positive and negative relationship between size and profitability for U.S. firms from different industries, suggesting that the relation may be contingent upon industry specific. Additionally, they found a negative correlation between profitability and the number of employees for firms of similar size, as measured by total assets and sales. Moreover, they observed that for some industries, profitability exhibits diminishing rates as firms grow larger and eventually decline. Similar observations suggesting that larger firms may be less efficient in terms of profitability were described by Yadav et al. (2021) in their study of 12 emerging Asia-Pacific countries. The same results illustrating the negative relationship between profitability and ROA for Polish companies listed on the Warsaw Stock Exchange were presented by Majerowska and Gostkowska-Drzewiecka (2018).

Therefore, the question regarding the relationship between firm size and firm performance remains an ongoing topic of debate. Firm market maturity is a typical control variable that illustrates its specifics and may have an impact on firm strategy, management decisions, and financial performance. In our model we use the number of years from the debut on the Warsaw Stock Exchange as a proxy for firm market maturity (*MAT*), illustrating how the company is dealing with new requirements when being listed. This approach is used in many studies as a proxy for firm age (Brahma et al., 2020; He et al., 2019; Peng & Tao, 2022). The link between firm performance and firm maturity (age) has been extensively studied with mixed results (Rossi, 2016). The negative relationship between firm maturity and firm performance is confirmed in empirical studies, e.g. Loderer and Waelchli (2010), Doğan (2013) for Turkish firms, and Rahman and Yilun (2021) for public firms in the Chinese context. However, evidence is also provided for a U-shaped relationship between firm maturity and performance, with an initially negative effect before positive returns are realized (Đặng et al., 2021).

The relationship between leverage (*LEV*) and financial performance, particularly profitability, is the subject of numerous studies in the context of financing decisions and capital structure theories (Koralun-Bereźnicka, 2019; Wiczorek-Kosmala, 2021). However, the results are mixed - some studies confirm the trade-off theory of capital structure, illustrating the positive relationship between leverage and profitability, while others provide evidence for the pecking order theory with a negative relationship between the level of debt and profitability. Studies also focus on the opposite direction, analyzing the interaction between profitability and firm leverage. Doğan (2013) and Yadav et al. (2021) found a negative relationship between profitability and firm leverage ratio. The same observation described Kędzior and Kędzior (2023) for Polish SMEs from the service industry, also Kaźmierska-Jóźwiak et al. (2015) for non-financial companies listed on the Warsaw Stock Exchange. Yoon and Jang, (2005) observed a positive relationship between the level of debt and firm profitability in the restaurant industry. Finally, Dalci (2018) and Nikhil et al. (2024) proved that the impact of leverage on profitability is inverted U-shaped. The positive impact of leverage on profitability arises from the tax shield, while the negative one – from

the bankruptcy costs and agency problems. These observations are consistent with the trade-off theory of capital structure. Bukalska and Radman-Pesa (2018) found differences in the direction of relationship due to the type of profitability ratio, as they observed a positive relationship between debt and ROE and a negative relationship between debt and ROA. As to the relationship between leverage and market value, it is expected that firms with lower leverage may have higher MV/BV ratios, as investors perceive them as less risky. Thus, this inconsistency may motivate further studies in this field. In our study, we use debt-to-asset ratio as a proxy for firm leverage, informing about the level of financial risk.

The relationship between asset tangibility (*TANG*) and financial performance is significant, as evidenced by Jha and Kumar (2024), however, the results are mixed. On the one hand, Kędzior and Kędzior (2023) examined SMEs operating in the service sector in Poland and found that asset tangibility negatively impacts firm profitability. The same negative relationship between profitability and asset tangibility was confirmed for Asian companies by Yadav et al. (2021). On the other hand, Majerowska and Gostkowska-Drzewiecka (2018) found that for the companies listed on the WSE in 1998-2016, an increase in the tangibility ratio leads to an increase in ROA. The opposite direction may be expected for the relationship between asset tangibility informing about business risk and MV/BV ratio, as less risky firms are characterized by better market performance. In our study, we measure asset tangibility by fixed assets to total assets ratio and use it as a proxy for business risk linked to the operations sector. The methods for computing the variables are outlined in Table 1.

Table 1. The formulas of the variables applied in the study

Dependent variables	Financial performance	Symbol
ROA	Return on assets = net profit to total assets	ROA
MV/BV	Market value to book value	MVBV
Independent variables	sustainability performance, board characteristics, ownership characteristics	
Sustainability measure ESG aggregate index	ESG aggregated index derived from five key components: WIG_ESG, ESG risk rating, GRI standard, ESG report, ESG board member	ESGaggr
Management board size	Ln from the number of members on the management board	LnBoard
Women on the management board	Percentage of women on the management board	Board_W
State ownership	Percentage of shares held by the state	State_own
Financial investors ownership	Percentage of shares held by financial investors	Fin_own
Managerial ownership	Percentage of shares held by CEO	Man_own
Family firm	Dummy variable: <ul style="list-style-type: none"> • 1 if the person who founded or acquired the company, together with his or her relatives and descendants, holds at least 25 percent of the voting rights at the company's general meeting of shareholders company (WSE classification), • and 0 otherwise. 	Fam_own
Ownership concentrations 3	The percentage of shares held by the three biggest owners	Own_3
Ownership concentrations 1	The percentage of shares held by the first owner	Own_1
Control variables		
Size	Ln from total assets	Size
Leverage	Total debt to total assets	Lev
Tangibility	Fixed assets to total assets	Tang
Market maturity	Ln from the number of years the company is present on the WSE	Mat

RESULTS AND DISCUSSION

Table 2 provides descriptive statistics for the 651 firm-year observations. The mean return on assets (ROA) stands at 5.96%, slightly surpassing the median value of 5.19%. The average market-to-book value (MV/BV) ratio is 2.34, exceeding the median of 1.34. Referring to ESGaggr score values, the results indicate considerable variability in their ESG performance. The mean score is 0.2927, however, the median is substantially lower (at 0.20). A relatively high standard deviation of 0.2797 informs about significant dispersion around the mean, indicating a wide range of ESG performance among the companies analyzed. Overall, these results suggest that while some companies may have relatively high ESG scores, there

are also a significant number with lower scores, reflecting diverse environmental, social, and governance practices across the dataset.

On average, analyzed companies have a management board composed of several members, which closely aligns with the median of 4.00. However, the representation of women on these boards is relatively low, with an average of fewer than 1 woman serving (median equals zero). This observation signals room for improvement in gender diversity within board structures.

Table 2. Descriptive statistics of the analyzed variables

Variable	Obs	Mean	Median	Std. Dev.	Min	Max
ROA	651	5.967	5.19	13.97	-71.21	99.30
MVBV	651	2.34	1.34	8.819	-167.96	70.87
ESGaggr	651	0.2927	0.20	0.2797	0	1
lnBoard	651	1.29	1.38	0.44	0	2.48
Board_W	651	0.4516	0.0	0.6874	0	3.00
Board	651	4.02	4.0	1.77	1	12
State_own	651	4.94	0.0	15.28	0	72.17
Fin_own	651	18.99	13.61	20.40	0	87.54
Man_own	651	15.57	0.8	23.22	0	99.97
Own_3	651	56.37	37.0	16.90	0.4153	99.97
Own_1	651	38.89	57.0	19.34	0.29	99.97
Lev	651	0.506	0.50	0.191	0.049	1.98
Tang	651	0.5295	0.5352	0.2176	0.0103	0.9384
Mat	651	9.79	10	4.81	0	22.00
Assets (mln PLN)	651	5267.25	1262.95	12625.46	21.28	106754

The findings show a wide range in the values of total assets and a large disparity between the mean and median values, with a mean value of 5,267.25 million PLN, a median of 1,262 million PLN. The maximum value of total assets equals 106,754 million PLN (it is the value of PKN Orlen's total assets in 2021). In contrast, the minimum value of total assets is only 21,28 million PLN. The average time the companies are listed on the WSE is close to 10 years.

The results indicate the variability in ownership structures among the companies, with varying levels of *FIN_OWN*, *MAN_OWN*, and *STATE_OWN*. The variable *FAM_OWN* is a binary variable (equal to 1 if a company is classified as a family firm by the Warsaw Stock Exchange, and 0 otherwise). Therefore, we are providing a frequency distribution of this variable. As presented in Table 3, 215 firm observations are classified as family companies in our database, accounting for 33.03 percent of the total sample.

Table 3. The frequency distribution of the values of a variable *FAM_OWN*

Data	Frequency	Percent
0	436	66.97
1	215	33.03
Total	651	100.00

Table 4 presents the coefficients of the pairwise correlation between the independent variables and the coefficients of variance inflation factors (VIF). According to the literature, values greater than 5.0 indicate significant concerns regarding collinearity (Hair et al., 2013). Since all VIF values are lower than this threshold, there is no collinearity concern.

Table 4. Correlation matrix between independent variables

Variables	1	2	3	4	5	6	7	8	9	10	11	12	13	VIF
1. ESGaggr	1.000													2.08
2. lnBoard	0.462 ***	1.000												3.71
3. Board_W	0.185 ***	0.346 ***	1.000											1.33
4. Fam_own	-0.139 ***	-0.178 ***	0.085 **	1.000										1.36
5. State_own	0.315 ***	0.1518 ***	-0.101 ***	-0.227 ***	1.000									1.65
6. Fin_own	-0.036	0.052	0.003	-0.218 ***	-0.203 ***	1.000								1.32
7. Man_own	-0.191 ***	-0.049	0.079 **	0.337 ***	-0.2174 ***	-0.277 ***	1.000							1.36
8. Own_1	0.032	-0.008	-0.009	0.225 ***	0.215 ***	-0.119 ***	0.149	1.000						3.8
9. Own_3	-0.130 ***	-0.045	0.0338	0.217 ***	0.051	-0.001	0.222 ***	0.822 ***	1.000					3.71
10. Size	0.644 ***	0.543 ***	0.031	-0.224 ***	0.431 ***	-0.0001	-0.239 ***	0.228 ***	0.091 **	1.000				2.79
11. Lev	0.107 ***	0.115 ***	-0.0270	0.023	-0.090 **	-0.030	0.137 ***	0.072 *	0.121 ***	0.168 ***	1.000			1.16
12. Tang	0.243 ***	0.044	0.089 **	-0.153 ***	0.265 ***	-0.057	-0.206 ***	0.137 ***	0.081 **	0.226 ***	-0.070 *	1.000		1.20
13. Mat	0.110 ***	0.073 *	-0.122 ***	-0.137 ***	-0.124 ***	0.229 ***	-0.084 **	-0.026	-0.060	0.190 ***	-0.088 **	0.005	1.000	1.23
													Mean VIF	1.91

Note: ***, **, * significant at 1%, 5%, 10% respectively.

Two methods were employed in this study to estimate the panel regression model: the fixed effects approach and the random effects approach. Based on the results of the Hausman test, the random effects model was selected as more suitable than the fixed effects model. We conducted estimations across various models using different explanatory variables and two dependent variables to measure firm performance, from the accounting (*ROA*) and market perspective (*MV/BV*). Tables 5 and 6 present the estimation results of the seven specifications of the general panel regression models, which verify the hypotheses formulated in the study. Each table presents estimation results for six models, incorporating different variables that describe specific types of ownership structure (financial, state, managerial, family) and ownership concentration. Model 1 incorporates family ownership (*FAM_OWN*), Model 2 includes State ownership (*STATE_OWN*), Model 3 focuses on financial investors ownership (*FIN_OWN*), Model 4 examines managerial ownership (*MAN_OWN*), Model 5 uses metric illustrating the holdings of the major shareholder as concentration measure (*OWN_1*), while Model 6 considers the holdings of top three shareholder (*OWN_3*). Finally, Model 7 encompasses all variables related to ownership structure characteristics.

Table 5. Results of the panel regression analysis (ROA)

Variables	Model 1	Model 2	Model 3	Model 4	Model 5	Model 6	Model 7
ESGaggr	3.760* (2.155)	4.230* (2.174)	3.794* (2.161)	3.839* (2.148)	3.875* (2.152)	3.864* (2.153)	4.343** (2.173)
lnBoard	-2.272 (1.414)	-2.368* (1.409)	-2.316 (1.410)	-2.174 (1.408)	-2.574* (1.422)	-2.130 (1.430)	-1.733 (1.433)
Board_W	2.068*** (0.732)	2.031*** (0.730)	2.093*** (0.730)	2.125*** (0.728)	2.116*** (0.729)	2.031*** (0.734)	1.744** (0.735)

Variables	Model 1	Model 2	Model 3	Model 4	Model 5	Model 6	Model 7
Mat	0.246* (0.132)	0.212 (0.133)	0.244* (0.134)	0.234* (0.132)	0.242* (0.132)	0.242* (0.132)	0.249* (0.136)
Leverage	-37.293*** (2.607)	-37.713*** (2.621)	-37.210*** (2.600)	-36.511*** (2.616)	-37.175*** (2.595)	-37.333*** (2.600)	-37.331*** (2.635)
Size	0.709 (0.609)	0.856 (0.617)	0.667 (0.601)	0.460 (0.610)	0.761 (0.605)	0.646 (0.601)	0.810 (0.634)
Tang	-24.897*** (3.053)	-24.452*** (3.065)	-24.931*** (3.048)	-25.395*** (3.051)	-24.641*** (3.054)	-25.002*** (3.046)	-24.689*** (3.083)
Fam_own	0.773 (1.959)						1.561 (2.124)
State_own		-0.070 (0.053)					-0.072 (0.060)
Fin_own			-0.003 (0.034)				-0.045 (0.037)
Man_own				-0.060* (0.031)			-0.076** (0.034)
Own_1					-0.048 (0.035)		-0.126** (0.054)
Own_3						0.029 (0.037)	0.153*** (0.055)
Constant	26.291*** (8.018)	25.131*** (7.900)	27.216*** (7.779)	30.781*** (7.979)	27.836*** (7.781)	25.729*** (7.973)	22.470*** (8.504)
Observations	651	651	651	651	651	651	651

Notes: Standard errors in parentheses. *** p<0.01, ** p<0.05, * p<0.1.

Table 6. Results of the panel regression analysis (MVBV)

Variables	Model 1	Model 2	Model 3	Model 4	Model 5	Model 6	Model 7
ESGaggr	3.391* (1.804)	3.637** (1.809)	3.294* (1.803)	3.507* (1.803)	3.298* (1.816)	3.411* (1.846)	3.639* (1.869)
lnBoard	0.318 (1.164)	0.149 (1.155)	0.292 (1.154)	0.157 (1.155)	0.114 (1.169)	0.217 (1.168)	0.165 (1.186)
Board_W	0.407 (0.625)	0.353 (0.627)	0.477 (0.619)	0.420 (0.621)	0.481 (0.622)	0.463 (0.625)	0.276 (0.637)
AgeMat	-0.147* (0.086)	-0.179** (0.089)	-0.128 (0.088)	-0.151* (0.086)	-0.155* (0.086)	-0.152* (0.086)	-0.150 (0.092)
Leverage	-13.145*** (2.088)	-13.545*** (2.122)	-13.059*** (2.078)	-13.383*** (2.110)	-13.013*** (2.088)	-13.068*** (2.102)	-13.920*** (2.168)
Size	-0.428 (0.369)	-0.304 (0.388)	-0.465 (0.366)	-0.398 (0.371)	-0.395 (0.381)	-0.454 (0.376)	-0.193 (0.408)
Tang	-6.320*** (1.981)	-6.126*** (1.988)	-6.585*** (1.960)	-6.253*** (1.981)	-6.399*** (1.976)	-6.493*** (1.977)	-5.898*** (2.038)
Fam_own	0.700 (0.947)						0.347 (1.051)
State_own		-0.038					-0.037

Variables	Model 1	Model 2	Model 3	Model 4	Model 5	Model 6	Model 7
		(0.032)					(0.035)
Fin_own			-0.025 (0.021)				-0.031 (0.023)
Man_own				0.017 (0.019)			0.008 (0.021)
Own_1					-0.013 (0.022)		-0.045 (0.040)
Own_3						0.000 (0.025)	0.039 (0.044)
Constant	17.983 *** (4.585)	17.255 *** (4.638)	19.156 *** (4.445)	17.817 *** (4.570)	18.569 *** (4.474)	18.763 *** (4.489)	15.392 *** (4.979)
Observations	651	651	651	651	651	651	651

Notes: Standard errors in parentheses. *** p<0.01, ** p<0.05, * p<0.1.

The results provide evidence for a significant positive relationship between a firm's sustainability performance, as measured by *ESGaggr*, and both, its accounting performance, illustrated by *ROA* and its market performance, measured by *MV/BV*. This suggests that firms with higher sustainability scores, as reflected in their ESG aggregate index (constructed by the authors), tend to be more profitable, as indicated by *ROA*, and tend to be better perceived by the investors (valuable) measured by *MV/BV*. This result supports hypothesis H1a and H1b and is also in line with the results of earlier studies: Velte (2017), Bodhanwala and Bodhanwala, (2018), Daszyńska-Żygadło (2019), Bassetti et al., (2020), Pham et al., (2021), Lourenço et al., (2013), Maso et al., (2023), and Buallay, (2019).

In almost all models, the parameters for both endogenous explanatory variables were insignificant at 0.05. This means that our findings do not provide evidence that there is a relationship between the size of the management board and firm performance, contrary to our expectations and to previous research suggesting either negative (Guest, 2009; O'Connell & Cramer, 2010; Augusto et al., 2019) or positive (Larmou & Vafeas, 2010; Pucheta-Martínez & Gallego-Álvarez, 2019) relationship between board size and firm performance. The findings suggest that having more members of the management board does not result in a better or worse firm performance, measured by both *ROA* and *MV/BV*. Therefore, the study findings do not support hypotheses H2a or H2b.

The analysis provides compelling evidence that the presence of women on the management board is associated with better accounting performance, measured by *ROA* (H3a). This means that having greater representation of women on the management board may lead to higher *ROA*, which is in line with the findings of Brahma et al. (2021). However, our results do not give evidence of a significant relationship between the presence of women on the management board and market performance, measured by *MV/BV*. Therefore, hypothesis H3b did not find support in the results. These findings align with those of Li and Chen (2018).

Contrary to our expectations, our findings regarding the relationship between ownership concentration and firm performance are inconsistent. The results suggest a negative statistically significant relationship between the level of shares owned by the first largest shareholder (*OWN_1*), and a positive statistically significant relationship between the level of shares owned by the three largest shareholders (*OWN_3*) and firm performance measured by *ROA* (Model 7). Prior studies also show inconsistent results. Some authors claim that large blockholders can be effective for monitoring managers, thus resulting in positive firm performance (Iwasaki & Mizobata, 2020; Mak & Kusnadi, 2005). Some state that the presence of blockholders might increase information asymmetry, affecting firm performance (Demsetz & Villalonga, 2001; Villalonga & Amit, 2006). Interestingly, Laporšek et al. (2021) did not confirm a statistically significant relationship between ownership concentration and firm performance. Therefore, we argue that the discussion on the importance of ownership concentration should remain open, and further research may use other measures of ownership concentration.

The findings show a negative and statistically significant relationship between the level of managerial ownership (*Man_own*) and firm performance measured by *ROA*. These results contradict prior research indicating a positive relationship between managerial ownership and firm performance (Kyeré & Ausloos, 2020; Zandi et al., 2020) but add arguments to the discussion on the negative effects of managerial ownership as suggested by Demsetz (1983) and Fama and Jensen

(1983a & b). On the other hand, our results do not confirm a relationship between the level of managerial ownership and market firm performance measured by MV/BV. This means that managerial shareholding does not influence MV/BV value. This result is consistent with Kyere and Ausloos (2020).

Finally, we did not find any evidence for the relationship between financial ownership, state ownership, family ownership and firm performance, measured by both ROA and MV/BV ratios. Therefore, hypotheses H5a and H5b can not be supported. Contrary to our expectations, ownership structure is not related to firm performance.

Furthermore, the results confirm the positive relationship between firm maturity (Mat) and firm performance, as measured by both ROA and MV/BV. Therefore, we may expect that more matured firms (the maturity measured by the number of years of presence on the Warsaw Stock Exchange) will demonstrate higher performance measures. Interestingly, our findings contradict previous studies, which suggested either a negative relationship between firm age and firm performance (Loderer & Waelchli, 2010; Doğan, 2013), Rahman & Yilun, 2021), or proposed a U-shaped relationship (Dang et al., 2022). These discrepancies in the results may arise from the way we measure firm age or from the specific situation of the Polish economy.

Our findings also confirm a negative relationship between leverage and firm performance, as measured by both ROA and MV/BV, suggesting that companies with higher debt levels in their capital structure tend to achieve lower profitability and lower market valuation. This observation aligns with earlier research by Bukalska and Radman-Pesa (2018), who found a negative relationship between debt levels and ROA. Such negative relationships may arise from bankruptcy costs and agency costs of debt, which are particularly important in highly leveraged firms.

Finally, the results provide evidence for a negative relationship between tangibility and firm performance, using ROA and MV/BV measures. This observation implies that companies with higher levels of fixed assets tend to exhibit lower firm performance. This negative correlation between tangibility and firm performance may be attributed to the impact of asset structure on cash levels, investments and capital structure, as well as reduced flexibility and increased operating costs leading to higher operating risk. These results are consistent with observations presented by Kędzior and Kędzior (2023) and Yadav et al. (2021).

CONCLUSION

The main objective of our study was to investigate the nexus between corporate sustainability performance and firm performance. Following panel regression analysis of data from Polish listed companies for a period spanning from 2015 to 2021, our results only enable us to support hypotheses regarding a positive relationship between sustainability performance and firm performance, as well as a positive relationship between the gender diversity of the management board and firm performance (but in this case, only for accounting measure).

In line with our expectations, our study indicates a significant positive relationship between sustainability performance and financial performance, represented by ROA and MV/BV. Therefore, companies with better sustainability performance are expected to exhibit higher profitability of assets, which is in line with the synergic effect hypothesis and stakeholder theory. Furthermore, these companies are also better perceived by investors in the financial markets, leading to higher market valuation. This positive market response may be attributed to both enhanced corporate reputation and the growing popularity of impact investing (SRI) strategies. These findings provide compelling reasons for companies to undertake sustainability initiatives and integrate sustainability issues into their operations and strategy, as doing so not only aligns with ethical imperatives but also contributes to firm performance. Similarly, we observed a positive significant relationship between gender diversity on the management board and accounting performance. Consequently, firms with higher feminization ratios are expected to achieve higher profitability of assets. This positive association between women presence on board and ROA may be explained by stronger corporate governance mechanisms and improved risk management practices. Moreover, gender diversity on the management board offers opportunities of using various perspectives, skills and knowledge in the decision-making process, which may lead to innovations, more creative solutions, and improved financial results.

However, no significant relationship was found between feminization of the management board and market performance. This suggests that investors may not view the diversity of the management board as a key factor impacting their perception of the company and its future growth prospects. These results may underline that different factors contribute to accounting performance and market performance, confirming the necessity of using both approaches to

examine firm financial performance. In this way, our study contributes to the discussion on the importance of sustainability performance for firm results, as well as the role of women in strategic management.

The second board attribute - board size, measured by the number of board members, contrary to our expectations, proved to be an insignificant factor for firm performance. With regard to the ownership concentration, our findings are mixed. The positive relationship between firm performance and ownership concentration was observed only when considering the metric illustrating the holdings of the top three shareholders. Regarding different types of ownership structures, we only found a significant negative relationship between managerial ownership and firm performance in terms of accounting profitability. The remaining types of ownership structures, such as family ownership, state ownership and institutional investor ownership, did not present any significant relationship with firm performance. Therefore, we may expect that other corporate governance mechanisms may be more important than ownership structure in the context of firm performance.

Among our control variables, only leverage and tangibility were found to be significant predictors of firm performance, both showing a negative relationship. Conversely, firm market maturity proved to be positively associated with firm performance. The remaining control variables did not show any significant association with firm performance.

Our study not only contributes to the corporate finance and sustainability literature, but also provides insights for corporate governance research, in particular, with regard to the importance of the board gender diversity. The policy suggestions derived from our findings can benefit both managers and regulators, focusing on the sustainable development paradigm, ultimately enhancing overall stakeholder well-being.

The main limitations of this study stem from the sample size and single-country setting. Therefore, further research could encompass a larger sample of firms across different countries, such as Visegrad Group (V4) countries or other Central European countries. Focusing on these regions could provide valuable comparative insights into how sustainability practices and firm performance interplay within varying regulatory and cultural contexts. Another limitation may be linked to the way we measure sustainability performance and define firm performance, given various approaches to these metrics. Therefore, future research could explore a more comprehensive understanding of the relationship between sustainability practices and firm performance. Further research may apply different measures of financial performance and consider time and sector effects in the broader analysis.

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Biographical notes

Joanna Błach (Ph.D., Hab.) is an Associate Professor at the Department of Corporate Finance and Insurance at the Faculty of Finance, University of Economics in Katowice, Poland. Her research interests include corporate financial strategy, financial innovations, and corporate governance. She gives lectures on corporate finance, financial analysis, sustainable finance and financial economics. She is a member of the Polish Economic Association, British Accounting and Finance Association and European Finance Association.

Elżbieta Bukalska (Ph.D., Hab.) is an Associate Professor at the Department of Corporate Finance and Accounting at the Faculty of Economics, Maria Curie-Skłodowska University in Lublin, Poland. She specializes in the financial market, corporate capital structure, and dividend policy. She gives lectures on corporate finance, financial analysis, and business planning. She is a member of the Polish Economic Association, a Lublin branch.

Bogna Kaźmierska-Józwiak (Ph.D., Hab.) is an Associate Professor at the Department of Corporate Finance Management at the Faculty of Management, University of Lodz, Poland. Her research interests focus on the various aspects of corporate finance, including capital structure, payout policy, Mergers and Acquisitions. Her teaching areas of interest includes corporate finance, financial planning, mergers and acquisitions.

Anita Radman Pesa (Ph.D.) is a Professor at the Department of Economics at the University of Zadar, Croatia. She has been teaching financial integration, risk management, microeconomics, and EU economics. She has published scientific papers indexed in WoS and Scopus, mainly through scientific projects in the areas of finance, risk, and EU integration.

Authorship contribution statement

Joanna Błach: Conceptualization, Data Curation, Investigation, Methodology, Resources, Visualization, Roles/Writing Original Draft, And Writing - Review & Editing. **Elżbieta Bukalska:** Conceptualization, Data Curation, Formal Analysis, Investigation, Methodology, Supervision, Visualization, Roles/Writing Original Draft, And Writing - Review & Editing. **Bogna Kaźmierska-Józwiak:** Conceptualization, Data Curation, Formal Analysis, Investigation, Methodology, Resources, Software, Supervision, Validation, Roles/Writing Original Draft, And Writing - Review & Editing. **Anita Radman Pesa:** Methodology, Validation, Roles/Writing Original Draft, And Writing - Review & Editing.

Conflicts of interest

The authors declare no conflict of interest.

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Firm size as a moderator of stakeholder pressure and circular economy practices: Implications for economic and sustainability performance in SMEs

Tarlan Ahmadov¹ , Susanne Durst² , Wolfgang Gerstlberger³ 
Quang M. Nguyen⁴ 

Abstract

PURPOSE: This study examines the interplay between stakeholder pressure (internal and external), circular economy (CE) practices, firm size, and their impact on the sustainability and economic performance of Small and Medium sized Enterprises. This research underscores firm size as a key moderator in the relationship between stakeholder pressures and CE adoption, aiming to provide a comprehensive understanding of this dynamic in SMEs. **METHODOLOGY:** Based on a cross-sectional survey of 124 SMEs in Estonia, Latvia, and Lithuania, with respondents primarily being owners and managers of firms, a three-step approach tested the proposed model for CE practices. First, Confirmatory Factor Analysis (CFA) was used to ensure that the observed variables represented latent constructs. Second, Ordinary Least Squares (OLS) and Weighted Least Squares (WLS) regression methods were used to control for factors influencing CE adoption. Finally, the interaction terms assessed the moderating role of firm size. **FINDINGS:** The research shows that firm size moderates these effects, with external stakeholder pressure significantly influencing CE adoption more than internal pressure. These finding underscores how firm size shapes SMEs' responses to stakeholder pressure when adopting CE practices. **IMPLICATIONS:** This study provides empirical evidence that stakeholder pressure significantly influences SMEs in the Baltic States to adopt CE practices, thus impacting economic and sustainability performance. Smaller firms can enhance CE practices by strategically managing stakeholders, whereas larger SMEs should align with external stakeholder expectations for more effective CE initiatives, leading to improved organizational performance. **ORIGINALITY AND VALUE:** This study demonstrates how stakeholder pressures drive CE practices and impact organizational sustainability and economic performance. Firm size plays a crucial role as a moderator amplifying the influence of external stakeholder pressure on CE practices.

Keywords: Stakeholder Pressure, Circular Economy Practices, Small and Medium-sized Enterprise, Sustainability Performance, Economic Performance, Baltic States

1 Tarlan Ahmadov, PhD Candidate, School of Business and Governance, Tallinn University of Technology, Ehitajate tee 5, Tallinn 19086, Estonia, tarlan.ahmadov@taltech.ee & Visiting Researcher at RISE, Research Institute of Sweden, Gothenburg, Sweden (ORCID: 0000-0002-6010-9097)

2 Susanne Durst, Dr. Prof., Department of Business and Economics, Reykjavik University, Menntavegur 1, 102 Reykjavik, Iceland & School of Business and Governance, Tallinn University of Technology, Ehitajate tee 5, Tallinn 19086, Estonia, e-mail: susanned@ru.is (ORCID: 0000-0001-8469-2427).

3 Wolfgang Gerstlberger, Dr. Assoc. Prof., School of Business and Governance, Tallinn University of Technology, Ehitajate tee 5, Tallinn 19086, Estonia, wolfgang.gerstlberger@taltech.ee (ORCID: 0000-0001-6200-5737).

4 Quang M. Nguyen, PhD Candidate, Department of Economic Analysis, University of Valencia, Avd. Tarongers sn, Valencia 46022, Spain, quangm.nguyen@outlook.com (ORCID: 0009-0009-2346-2420).

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INTRODUCTION

The European Commission's ambitious vision outlined in "A Clean Planet for all - A European strategic long-term vision for a prosperous, modern, competitive and climate neutral economy" emphasizes the goal of achieving carbon neutrality by 2050 (European Commission, 2018). However, this objective hinges on the active involvement of larger companies integrating small and medium-sized enterprises (SMEs) into their carbon reduction strategies. The European Union defines SMEs as businesses that employ up to 250 people with an annual turnover of up to EUR 50 million (European Commission, 2020) and play a pivotal role in global business, accounting for about 90% of all businesses and over 50% of global employment (World Bank, 2021). In the European Union alone, around 25.1 million SMEs employ over 94 million people, constituting about 66% of the workforce (Statista, 2021).

However, despite their economic significance, SMEs are also responsible for a considerable portion of industrial pollution, contributing 60–70% of Europe's industrial pollution, particularly in the manufacturing sector (Koirala, 2019; OECD, 2019). For instance, manufacturing SMEs are responsible for 64% of air pollution; however, only 0.4% of these enterprises adhere to environmental management schemes (Bonner, 2019). Given that SMEs allocate a substantial share of their revenue to materials and services (Krajewski & Malhotra, 2022), their operational choices significantly impact global resource consumption, pollution levels, and waste generation. Therefore, the integration of SMEs into sustainability initiatives is essential for the success of global environmental strategies, such as those outlined in the EU Green Deal and other carbon reduction policies (Chatzistamoulou & Tyllianakis, 2022).

SMEs face intense competition, demand uncertainties, cash flow challenges, and skill shortages, which complicate their adoption of environmentally and socially responsible practices (Dey et al., 2020). Their financial performance heavily influences decisions related to practices, such as lean methodologies, eco-friendly design, and sustainable procurement (Dey et al., 2022; Łasak, 2022). Additionally, external pressures from clients, policymakers, and market dynamics significantly shape strategic choices. However, several obstacles, such as insufficient financial backing, outdated information systems, inadequate technology, and limited access to technical expertise, hinder SMEs from integrating advanced environmental practices (Ahmadov et al., 2023; Prieto-Sandoval et al., 2018). This constellation can have adverse effects on the long-term sustainability of SMEs, which is crucial for economic progress, mitigating environmental harm, and complying with low-carbon strategies set forth by policymakers (such as the EU carbon tax and EU ETS in 2021). Failure to do so can impede global efforts to address climate change.

The concept of a circular economy (CE) has emerged as a transformative approach to address the environmental and resource challenges posed by traditional linear economic models (Cagno et al., 2023; Knable et al., 2022). CE aims to decouple economic growth from resource consumption and environmental degradation by promoting practices such as recycling, reuse, repair, and efficient use of resources (Franzo et al., 2021). Governments, companies, and influential figures from various sectors are increasingly recognizing the importance of transitioning to CE to combat resource scarcity (Maher et al., 2023) and mitigate environmental impacts (Yang et al., 2023). This urgency stems, among other things, from the pressure exerted on the global economy by the continuous consumption of finite resources (Ibn-Mohammed et al., 2021). However, despite growing attention and efforts, the global economy's circularity remains low, with only 8.6% being circular, and resource recycling rates generally insufficient (Circle Economy, 2020).

While several large enterprises and governments have started adopting CE practices (Garces-Ayerbe et al., 2019), it is more difficult for smaller enterprises, as they seem to face distinct challenges caused by limited resources and expertise (Ahmadov, Durst, & Gerstlberger, 2024; Mura et al., 2020). Existing literature has shed light on various aspects of SMEs' transition to CE. Castro-Lopez et al. (2023), for example, examine the effects of external pressures and organizational agility on adopting circular business models and specific circular practices and found that both factors drive strategic and practice-level changes in manufacturing firms. Sahoo's (2024) research supports the notion that stakeholder pressure influences firms to develop capabilities, such as green data analytics, which indirectly impacts environmental performance. John et al. (2023) focused on the construction sector, identifying logistics infrastructure and market share as critical factors for organizational growth transition towards CE.

Baral et al. (2023) explored the antecedents of CE capability in Indian MSMEs and found that social pressure and green economic incentives are significantly associated with CE capability mediated by environmental commitment and sustainable supply chain design. Bello-Pintado et al. (2023) analyzed the differentiated response of manufacturing companies to stakeholder pressures regarding sustainability practices, suggesting selective adoption based on stakeholder group and country development context. Ul-Durar et al. (2023) proposed a framework linking environmental innovation

with CE through organizational learning and orientation dynamics, emphasizing the role of knowledge resources in the transition towards CE. Hernández-Arzaba et al. (2022) investigated the impact of stakeholder pressure on the adoption of CE principles in Mexico, highlighting the significant role of external stakeholders in enhancing economic and environmental performance through CE. Fobbe and Hilletoft (2023) explored stakeholder engagement practices in Swedish manufacturing organizations, advocating for a shift from linear to circular stakeholder engagement to facilitate CE implementation. A recent study by Ahmadov et al. (2024), involving Estonian micromanufacturing firms demonstrates the significance of stakeholder pressure in driving the adoption of CE practices, highlighting the distinction between internal and external pressures. However, the scope of this study is limited, as it focuses exclusively on micro firms and considers company export status as the sole contextual factor.

Despite recent progress in the study of CE practices, such as research highlighting the importance of external pressures and organizational agility in driving CE adoption (Castro-Lopez et al., 2023), the role of stakeholder pressure in fostering environmental capabilities (Sahoo, 2024), and sector-specific factors influencing CE transitions (John et al., 2023), there is still a gap in understanding how firm size moderates the relationship between these pressures and CE adoption. This potential relationship is particularly relevant in resource-constrained SMEs (Baral et al., 2023; Bello-Pintado et al., 2023). In addition, much of the current research has been conducted in larger economies. In Europe, it can be seen that the eastern countries, in particular, are lagging behind in terms of development towards CE (Mazur-Wierzbicka, 2021). This trend is also evident in the Baltic States, as noted by Ahmadov et al. (2024). Despite progress in sustainability initiatives, SMEs in these countries face structural and policy-related barriers to fully transitioning to circular models. Our study addresses these limitations by investigating the moderating role of firm size in the relationship between stakeholder pressure and CE practices, with a specific focus on SMEs in the Baltic States. Considering recent conceptualizations and empirical studies, this study addresses the following research questions (RQs):

RQ1) How does firm size moderate the relationship between stakeholder pressure (internal and external) and the adoption of circular economy practices in manufacturing small and medium-sized enterprises?

RQ2) What impact does this relationship have on sustainability and economic performance?

The remainder of the paper is structured as follows. The next section delves into the background of CE, the role of stakeholders in the CE context, and the significance of firm size. This is followed by an explanation of the research methods used in this study. The next section presents the findings, followed by a discussion of the results. Finally, the paper concludes with recommendations for future research.

LITERATURE BACKGROUND AND HYPOTHESIS DEVELOPMENT

The literature emphasizes the crucial role of stakeholder pressure, which involves the influence exerted by various stakeholders to align a company's operations with their interests and expectations in shaping the adoption of CE practices (Baah et al., 2023; Jakhar et al., 2019). Stakeholders can effectively drive CE initiatives by promoting awareness, establishing governance policies, implementing regulatory actions, fostering stakeholder collaboration, and utilizing digital technologies, such as blockchain (Ahmadov, Durst, Mendoza, et al., 2024; Munaro & Tavares, 2023; Senaratne et al., 2023). Stakeholder involvement plays a key role in creating resilient and adaptive value creation networks (Durst et al., 2020). Baah et al. (2022) and Rodríguez-Espíndola et al. (2022) stressed the obstacles faced by SMEs in voluntarily embracing CE, highlighting the vital impact of external pressures. This study asserts that the absence of stakeholder pressures impedes the adoption of CE practices in industrial settings. This aligns with growing awareness among stakeholders about ecological and social issues, leading to increased calls for companies to align their operations with environmental and social concerns (Jakhar et al., 2019; Winans et al., 2021).

According to Govindan and Hasanagic (2018), the government plays a vital role in pressuring firms to implement CE. This finding is supported by Genovese et al. (2017) argument that external stakeholder pressure encourages the adoption of CE practices, emphasizing the importance of stakeholder pressure in integrating CE practices (Ahmadov, Gerstlberger, & Rahman, 2024; Baah et al., 2022; Chiappetta Jabbour et al., 2020; Winans et al., 2021). Internal stakeholders, also have a significant influence, potentially surpassing that of external stakeholders in promoting CE business models (Chiappetta Jabbour et al., 2020). Failure to address stakeholder pressures regarding CE can result in a loss of trust and reputation,

which are critical for business sustainability (Hernández-Arzaba et al., 2022; Souza Piao et al., 2024). Therefore, it is crucial for SMEs to respond to stakeholder pressure to avoid these consequences.

To further develop a nuanced understanding, it is crucial to distinguish between internal and external stakeholder pressure. While the literature has extensively documented the impact of stakeholder pressure on the adoption of CE practices, most studies tend to aggregate these pressures without considering the differing roles and influences of internal versus external stakeholders. Understanding the interplay between internal and external stakeholders is essential, as these groups exert different types of pressure that uniquely shape a company's sustainability and competitiveness (Ahmadov, Gerstlberger, & Rahman, 2024; González-Rodríguez et al., 2019). Recognizing these distinctions is essential for comprehending the complex dynamics that influence the adoption of CE practices. Building on these insights, we propose the following hypotheses:

H1: Internal stakeholder pressure has a positive effect on the CE practices of SMEs.

H2: External stakeholder pressure has a positive effect on the CE practices of SMEs.

The impact of CE practices on the economic performance of SMEs is a subject of increasing interest in the academic literature (Dey et al., 2022). Recent studies have shown that the adoption of CE practices, including waste reduction, reuse, and recycling, can lead to improved economic performance for SMEs (Feng & Goli, 2023; Mazzucchelli et al., 2022). This is attributed to potential cost savings from resource efficiency and the creation of competitive advantages offered by CE practices (Tan et al., 2024).

However, the relationship between CE and economic performance is not always direct. Some studies suggest that the positive impact of CE on economic performance may be mediated by factors such as brand reputation (Mazzucchelli et al., 2022), supply chain practices (Khan et al., 2023), or information systems (Natrajan et al., 2024). Additionally, the role of transformational leadership and fintech adoption has been highlighted as important for enhancing the sustainable performance of SMEs within a circular framework (Hidayat-ur-Rehman & Alsolamy, 2023). Given this context, we propose the following hypothesis:

H3: The adoption of CE practices positively influences the economic performance of SMEs.

In addition to economic performance, the adoption of CE practices along with sustainable supply chain practices, has been shown to significantly enhance SMEs' sustainable performance (Khan et al., 2023). Similarly, green logistics management, when mediated through circular economy practices, positively affects sustainability performance (Zhou et al., 2023). Moreover, circular economy practices have been found to be effective leverage for sustainable corporate development, with innovation and digital transformation strategies amplifying this positive impact (Chau et al., 2023). However, a specific gap exists in the understanding of how the relationship between CE practices and sustainability performance is influenced by firm size. Larger firms often have more resources to implement CE practices effectively and meet stakeholder demands more easily, while SMEs may face significant challenges due to resource constraints despite facing intense pressure from stakeholders (Ali & Johl, 2023; Carchano et al., 2023). Furthermore, prior research has not sufficiently differentiated the effects of internal and external stakeholder pressures on firms of varying sizes, which could provide critical insights into how CE practices can be tailored to enhance sustainability performance (Seroka-Stolka et al., 2020). Therefore, it is important to explore whether CE practices can directly enhance firms' sustainability performance.

H4: The adoption of CE practices positively influences the sustainability performance of SMEs.

In prior literature, firm size as a moderator has gained the attention of researchers (Ali & Johl, 2023; Farooq et al., 2021). Prior research has demonstrated that firm size moderates the relationship between CE practices and stakeholder pressures (Ali & Johl, 2023; Latip et al., 2022). Larger firms often face more intense stakeholder pressure owing to their higher visibility and more substantial environmental impact, leading them to adopt proactive environmental strategies (Seroka-Stolka et al., 2020). Additionally, larger firms are more likely to disclose carbon emissions and engage in environmental practices in response to regulatory and organizational stakeholder pressures (Chithambo et al., 2022). These dynamics highlight the need to understand how firm size shapes the relationship between external pressures and CE practices, as the larger the firm, the more it moderates stakeholder pressure.

By contrast, smaller firms experience different dynamics. They are typically more influenced by internal motivations than by external pressures when adopting CE practices (Carchano et al., 2023). However, when external pressure occurs, SMEs may struggle to respond effectively because of limited resources (Tyler et al., 2024). Research in various regional contexts, including China and Malaysia, highlights that firm size influences the integration of industry 4.0, sustainability practices, and CE capabilities (Courrent & Omri, 2022). In Malaysia, SMEs in the food manufacturing sector face varying levels of pressure from customers, regulatory bodies, and the social community regarding environmental behavior, which moderates the relationship between customer pressure and the intention to adopt Environmental Management Practices (EMPs) (Vidal et al., 2023).

These findings emphasize the importance of considering firm size as a moderating factor in the adoption of sustainable practices in response to stakeholder pressure, particularly in the context of CE principles and environmental performance. Understanding the moderating effect of firm size on stakeholder pressure and CE practices is crucial because SMEs, particularly in different regional contexts (such as the Baltic States), face unique challenges and resource limitations that influence their response to these pressures. By examining firm size as a moderator, this study aims to provide tailored insights into how SMEs can effectively navigate stakeholder demands and adopt CE practices to enhance sustainability performance.

H5: Firm size moderates the relationship between internal stakeholder pressure and the adoption of CE practices.

H6: Firm size moderates the relationship between external stakeholder pressure and the adoption of CE practices.

To comprehensively understand the dynamics influencing the adoption of CE practices in SMEs, it is essential to employ both Stakeholder Theory and Resource-Based View (RBV) as theoretical lenses. Stakeholder Theory posits that any party with an interest in a business can influence its decisions, practices, and value creation processes (Freeman et al., 2010). These stakeholders are categorized into primary stakeholders, who are vital to an organization's continued existence, and secondary stakeholders, who may not directly influence a firm's operations (Sarkis et al., 2010). Thus, stakeholders can be both internal and external based on their fundamental roles and attributes (Govindan & Hasanagic, 2018). This theoretical framework helps elucidate how various stakeholder pressures, both within and outside the firm, drive the adoption and implementation of CE practices, shaping the firm's sustainability and competitive performance.

However, to fully capture the complexity of stakeholders' influence on CE practices, it is crucial to integrate the RBV perspective. RBV theory suggests that a firm's ability to respond to stakeholder pressures depends on its internal resources and capabilities (Barney, 1991). Firm size plays a pivotal role here as it affects the availability and strategic management of these resources. Larger firms generally have more financial capital, human resources, and technological capabilities, enabling them to better absorb and respond to stakeholder pressures, including those advocating for CE practices (Conrad, 1999; Nandi et al., 2021). In contrast, smaller firms, while often resource-constrained, can leverage their agility and innovative potential to implement CE practices effectively (Bassi & Guidolin, 2021; Rangone, 1999). Thus, the RBV provides a nuanced understanding of how firm size moderates the relationship between stakeholder pressure and CE adoption, suggesting that the impact of such pressure may vary depending on a firm's internal resource base.

Examining this study from these two theoretical perspectives is essential, as this dual-theoretical approach not only helps explain why firms of different sizes respond differently to stakeholder demands, but also provides deeper insights into the mechanisms through which stakeholder pressures can lead to the implementation of sustainable business practices. By considering both perspectives, this study aims to offer a holistic understanding of the factors that drive CE adoption in SMEs. This understanding contributes to the development of tailored strategies and policy interventions that address the unique challenges faced by firms of varying sizes. The hypothesized relationships are summarized in Figure 1.

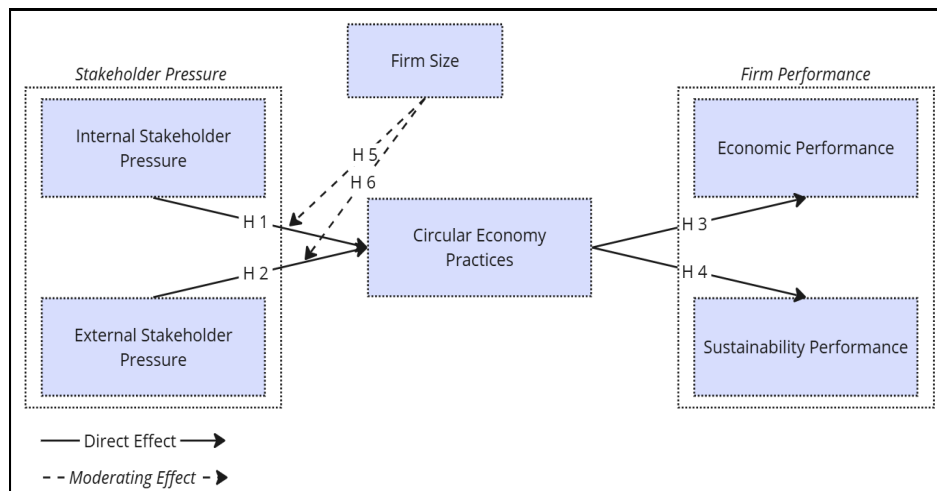


Figure 1. Research model

METHODOLOGY

Sampling strategy and data collection

A survey using standardized questionnaires was conducted to gather data to test the research hypotheses. The target population comprised of small and medium-sized enterprises operating in the manufacturing industry. For this study, SMEs are defined as firms with fewer than 250 employees, where micro firms have up to nine employees, small-sized firms have between 10 and 49 employees, and medium-sized firms have between 50 and 249 employees. We chose to survey Estonian, Latvian, and Lithuanian SMEs because of their unique geopolitical positions, shared history, and contemporary strategic concerns. These countries share a common history and geographical location and have undergone significant political and economic transformations since regaining independence in the early 1990s (Mälksoo, 2023). Their strategic positioning at the crossroads of the Eastern and Western markets, coupled with their EU membership, makes them an interesting case for examining the interplay between regional dynamics and business development (Kascian et al., 2024).

Obtaining data through questionnaires can be challenging, especially when respondents are required to have specialized knowledge, as was the case in this study on sustainability and CE. To ensure the feasibility of our survey, the researchers sought assistance from the local industry chambers. A representative sample of 1,500 SMEs was randomly selected from the Orbis Europe database. An invitation email was sent to these firms on November 14, 2023, explaining the research purpose and requesting their consent to participate in the survey via an online survey software (Qualtrics).

Follow-up and reminder emails were sent to encourage high response rates. In total, 521 surveys were started by respondents, but using the “complete case analysis” method to handle missing data (Hughes et al., 2019), incomplete and missing data questionnaires were discarded by the research team, resulting in 124 usable questionnaires being obtained with a response rate of 8.3% (124/1500), which is comparable to other survey-based firm-level studies (Holzer et al., 2021; Kitsis & Chen, 2020). Detailed profiles of the sampled firms are listed in Table 1.

Table 1. Sample profile

	Count	%		Count	%
Respondents profile			Education level		
Female	48	38.71	Diploma/certificate	34	27.42
Male	72	58.06	Undergraduate	37	29.84
Prefer not to say	4	3.23	Master’s degree	48	38.71
Position in company			Doctorate	5	4.03
Owner	62	50	Firm size		
Production manager	21	16.94	Micro	20	16.13

	Count	%		Count	%
Marketing manager	7	5.65	Small	74	59.68
Supply chain manager	2	1.61	Medium	30	24.19
Quality manager	7	5.65	Firm ownership		
Other	25	20.15	Family business	21	16.94
Firm age			Sole proprietor	8	6.45
Old	104	83.87	Partnership	4	3.23
Young	20	16.13	Limited company	91	73.39
			State-owned	0	0.00

Measures

All the items in this study were drawn from the existing literature and modified slightly to fit the current research context. Each item is measured on a five-point Likert scale from “1 = strongly disagree” to “5 = strongly agree.” A five-point Likert scale is common and has been frequently used in business management research (Bag et al., 2021; Dubey et al., 2019).

To capture CE practices, six items were adapted from Ali and Johl (2023) and Rodríguez-Espíndola et al. (2022). For internal pressure, including the influence of shareholders and employees, the items were drawn from Miras-Rodríguez et al. (2018) and Waxin et al. (2019). External pressure, representing the influence of customers, suppliers, and competitors, was assessed using items sourced from Chowdhury and Quaddus (2017) and Permatasari and Gunawan (2023).

In measuring sustainability performance, items were adapted from Nureen et al. (2023), and economic performance measures were drawn from Tian et al. (2023). In addition, firm size as a moderator variable was included in the survey. This decision was informed by prior literature highlighting the significance of firm size as a moderator in various contexts (Farooq et al., 2021; Wang et al., 2020). Furthermore, firm age and size were included as control variables to control for potential confounding effects (Jiao et al., 2020; Zhou et al., 2023).

Analysis

As our data were obtained from a single source, we initially assessed the risk of common method bias (CMB) using the Harman single-factor test (Harman, 1976). The results showed that one factor extracted 37.96% of the total variance, which is below the recommended threshold of 50% (Tehseen et al., 2017). Consequently, we concluded that CMB was not present in this study.

Next, we implemented a three-step approach to test the proposed hypotheses. First, we used Confirmatory Factor Analysis (CFA) to verify the underlying factor structure of our measurement. Second, Ordinary Least Squares (OLS) regression was employed to examine the effects of various factors potentially influencing the adoption of CE practices (multicollinearity was assessed for the OLS models; all VIF values were below 10, indicating no serious multicollinearity concerns). To control for potential confounding effects, variables such as firm age and size were included as control variables (Jiao et al., 2020; Zhou et al., 2018). Finally, we assess the moderating role of firm size using interaction terms. As a robustness check, the Weighted Least Squares (WLS) indicator was used as a supplement to the OLS.

RESULTS

Preliminary analysis

Table 2 presents the descriptive statistics and results of the confirmatory factor analysis of the variables used in our study. Among the stakeholders' pressures, customers “customers” exert the greatest influence on firms ($\mu = 3.6$), while “reuse of packaging materials” is the most widely adopted circular economy practice, having the highest mean ($\mu = 3.1$). Regarding economic performance, company’s “image” appears to be the most improved aspect ($\mu = 3.50$), whereas “created new jobs” seems to be the least likely among the aspects of sustainability performance ($\mu = 3.298$).

Table 2. Measurement items, descriptive statistics, and factor analysis

Measurement items	Mean	SD	Factor loadings
Internal Pressure			
Shareholders	2.758	1.327	0.558
Employees	2.855	1.234	0.613
External Pressure			
Customers	3.613	1.187	0.832
Suppliers	3.089	1.275	0.833
Competitors	2.984	1.182	0.638
Circular Economy Practices			
Use of renewable raw materials in products.	2.629	1.417	0.651
Reuse of post-consumer products and/or parts in production.	2.484	1.394	0.411
Reuse of leftover material to manufacture new products	3.065	1.430	0.590
Reuse of product packaging materials	3.113	1.461	0.455
During the production stage, use the least amount of energy and/or resources	2.960	1.334	0.547
During the product design stage, we consider recyclability.	2.629	1.428	0.841
Sustainability Performances			
More efficient use of resources and/or materials.	3.710	0.863	0.806
Reduced consumption of resources	3.589	0.988	0.646
Reduction of pollution and waste.	3.758	0.923	0.745
Reduced environmental impact in general.	3.694	0.876	0.756
Improved the quality of our products.	3.790	0.809	0.671
Improved the durability of our products.	3.565	0.913	0.605
Improved work safety.	3.750	0.833	0.648
Improved the work environment.	3.887	0.809	0.638
Created new jobs	3.298	1.119	0.449
Improved overall sustainability performance of the company.	3.710	0.881	0.769
Economic Performances			
Profitability	3.081	0.728	0.658
Sales	3.177	0.687	0.787
Market share	3.065	0.659	0.646
Customer satisfaction	3.492	0.656	0.763
Image	3.500	0.656	0.787
Overall success of the company	3.355	0.701	0.856

Note: Confirmatory factor analysis. SRMR (0.091), RMSEA (0.125), CFI (0.673), TLI (0.639), CD (0.999).

Table 2 also shows the factor loadings and goodness-of-fit statistics (the factor loadings are shown in the last column of Table 2). The goodness-of-fit statistics are shown at the bottom of Table). All items in the table have standardized factor loadings above the acceptable threshold of 0.4 (Field, 2005; Stevens, 1992; Tabachnick & Fidell, 2007). The SRMR (0.091) was slightly above the acceptable limit of 0.08, indicating a moderate fit in terms of residuals. However, RMSEA (0.125), CFI (0.673), and TLI (0.639) indicated that the model did not fit the data optimally. This may partly be attributed to the small sample size. Small sample sizes can affect the reliability of these fit indices (see, e.g., Marsh et al., 1988), making it difficult to accurately assess the model's true performance. While the fit statistics suggest caution in interpreting the exact magnitude of the effects, our study offers a meaningful contribution by exploring potential relationships between different theoretical aspects of a firm's behaviors, thus highlighting areas for further refinement with larger, more robust datasets in future research.

Table 3. Squared correlations (SC) matrix among latent variables

Variables	No. of items	CR	(1)	(2)	(3)	(4)	(5)
(1) CEP	6	0.760	0.359				
(2) IP	2	0.779	0.129	0.656			
(3) EP	3	0.815	0.230	0.351	0.598		
(4) ECP	6	0.887	0.152	0.018	0.061	0.567	
(5) SUP	10	0.894	0.350	0.049	0.080	0.192	0.463

Note: CEP = circular economy practices; IP = internal pressure; EP = external pressure; ECP = economic performance; SUP = sustainability performance. The Average Variance Extracted (AVE) (in italics) is shown on the diagonal. The off-diagonal values are the squared correlations between constructs. CR = Composite Reliability.

Table 3 presents the insights into the validity and reliability of the constructs. For discriminant validity, the analysis showed no issues across the latent variables. This is evident from the squared correlation (SC) matrix, where all off-diagonal values are lower than the AVE values for each latent variable. However, convergent validity was a concern for two variables: CEP (AVE = 0.359) and SUP (AVE = 0.463). These AVE values fall below the commonly accepted threshold of 0.5 (Hair et al., 2010; Malhotra & Dash, 2011), suggesting that these constructs may not explain enough of the variance in the indicators. The other three variables (IP, EP, and ECP) demonstrated satisfactory convergent validity, with AVE values above 0.5. In small sample sizes, a low AVE among certain variables might be expected due to sampling variability (Fornell & Larcker, 1981; Hair et al., 2010; Kline, 2023). When the sample size is small, the likelihood of variability in the estimates increases owing to random sampling errors. This can lead to inconsistent or unstable parameter estimates, including lower AVE values for certain constructs. As the sample size increased, the effects of sampling variability tended to diminish, leading to more stable and reliable estimates of AVE and other model parameters. Composite reliability (CR) scores with a threshold of 0.7 (Fornell & Larcker, 1981; Perry Hinton et al., 2004). As demonstrated in Table 3, all constructs were above the minimum requirement. Thus, our constructs were statistically reliable.

Hypothesis testing

We tested our proposed hypotheses using the results shown in Tables 4-7. Hypothesis H1 posits that internal stakeholder pressure has a positive impact on circular economy practices in SMEs, a proposition confirmed by our results. As indicated in Table 4, the association between CEP and IP is significant and positive ($\beta=0.113$, $p<0.01$). As shown in Table 5, EP also demonstrated a significant impact on CEP ($\beta=0.174$, $p<0.01$), thereby supporting hypothesis H2. When we control for more variables and confounding factors (i.e., SIZE, AGE, SUP, and ECP), the relationship remains strong. The significance of these relationships implies that IP and EP are key predictors of CEP in the model.

Table 4. The relationship between IP and CEP

	Dependent variable: CEP					
	(1)	(2)	(3)	(4)	(5)	(6)
IP	0.201*** (0.0762)	0.144** (0.0700)	0.143** (0.0721)	0.140* (0.0728)	0.132* (0.0730)	0.113*** (0.0143)
SUP		0.637*** (0.122)	0.635*** (0.124)	0.634*** (0.124)	0.574*** (0.134)	0.530*** (0.0265)
SIZE			0.0126 (0.127)	0.0199 (0.129)	0.0133 (0.129)	-0.0246 (0.0327)
AGE				0.0771 (0.214)	0.0592 (0.214)	0.0918*** (0.0295)
ECP					0.189 (0.157)	0.215*** (0.0214)
constant	2.248*** (0.230)	0.0680 (0.467)	0.0517 (0.497)	-0.0382 (0.557)	-0.380 (0.625)	-0.218** (0.0897)
N	124	124	124	124	124	124

Note: Standard errors are in parentheses. * $p<0.1$ ** $p<0.05$ *** $p<0.01$. Models 1 through 5 employed Ordinary Least Squares (OLS) regression, while Model 6 utilized Weighted Least Squares (WLS) regression, using the inverse of the squared residuals as the weights. CEP = circular economy practices; IP = internal pressure; SUP = sustainability performance; SIZE = firm size; AGE = firm age; ECP = economic performance.

Table 5. The relationship between EP and CEP

	Dependent variable: CEP					
	(1)	(2)	(3)	(4)	(5)	(6)
EP	0.291*** (0.0803)	0.204*** (0.0759)	0.202*** (0.0763)	0.199** (0.0771)	0.188** (0.0777)	0.174*** (0.0119)
SUP		0.598*** (0.123)	0.591*** (0.124)	0.590*** (0.125)	0.541*** (0.133)	0.591*** (0.0474)
SIZE			0.0460 (0.123)	0.0514 (0.124)	0.0442 (0.125)	0.0413 (0.0324)
AGE				0.0661 (0.211)	0.0514 (0.211)	0.115 (0.0720)
ECP					0.164 (0.156)	0.151*** (0.0496)
constant	1.872*** (0.272)	-0.0413 (0.466)	-0.107 (0.499)	-0.183 (0.557)	-0.473 (0.621)	-0.626*** (0.170)
N	124	124	124	124	124	124

Note: Standard errors are in parentheses. * p<0.1 ** p<0.05 *** p<0.01. Models 1 through 5 employed Ordinary Least Squares (OLS) regression, while Model 6 utilized Weighted Least Squares (WLS) regression, using the inverse of the squared residuals as the weights. CEP = circular economy practices; EP = external pressure; SUP = sustainability performance; SIZE = firm size; AGE = firm age; ECP = economic performance.

Hypothesis H3 states that circular economic practices have a positive effect on firm-level economic performance. As shown in Table 6, the relationship between the two variables is positive and significant ($\beta=0.136$, $p<0.01$). Similarly, as shown in Table 7, circular economy practices positively affect firm-level sustainability performance ($\beta=0.273$, $p<0.01$), providing empirical support for hypothesis H4.

Table 6. The relationship between CEP and ECP

	Dependent variable: ECP					
	(1)	(2)	(3)	(4)	(5)	(6)
CEP	0.159*** (0.0487)	0.157*** (0.0489)	0.151*** (0.0493)	0.142*** (0.0504)	0.127** (0.0518)	0.136*** (0.00927)
AGE		0.0928 (0.128)	0.110 (0.129)	0.0983 (0.130)	0.0880 (0.130)	0.0461** (0.0217)
SIZE			0.0778 (0.0756)	0.0620 (0.0779)	0.0624 (0.0777)	0.0496*** (0.0159)
IP				0.0386 (0.0449)	0.0161 (0.0483)	0.0102 (0.00908)
EP					0.0652 (0.0520)	0.0711*** (0.00776)
constant	2.830*** (0.145)	2.727*** (0.202)	2.562*** (0.258)	2.526*** (0.262)	2.434*** (0.271)	2.477*** (0.0431)
N	124	124	124	124	124	124

Note: Standard errors are in parentheses. * p<0.1 ** p<0.05 *** p<0.01. Models 1 through 5 employed Ordinary Least Squares (OLS) regression, while Model 6 utilized Weighted Least Squares (WLS) regression, using the inverse of the squared residuals as the weights. ECP = economic performance; CEP = circular economy practices; SIZE = firm size; AGE = firm age; IP = internal pressure; EP = external pressure.

Table 7. The relationship between CEP and SUP

Dependent variable: SUP						
	(1)	(2)	(3)	(4)	(5)	(6)
CEP	0.297*** (0.0536)	0.296*** (0.0539)	0.288*** (0.0542)	0.284*** (0.0556)	0.269*** (0.0572)	0.273*** (0.00577)
AGE		0.0112 (0.141)	0.0362 (0.142)	0.0308 (0.143)	0.0208 (0.143)	0.0172** (0.00795)
SIZE			0.110 (0.0832)	0.103 (0.0859)	0.104 (0.0858)	0.0954*** (0.00479)
IP				0.0172 (0.0495)	-0.00471 (0.0533)	-0.00443 (0.00473)
EP					0.0632 (0.0574)	0.0661*** (0.00232)
constant	2.841*** (0.159)	2.828*** (0.223)	2.594*** (0.284)	2.578*** (0.289)	2.489*** (0.300)	2.491*** (0.00355)
N	124	124	124	124	124	124

Note: Standard errors are in parentheses. * p<0.1 ** p<0.05 *** p<0.01. Models 1 through 5 employed Ordinary Least Squares (OLS) regression, while Model 6 utilized Weighted Least Squares (WLS) regression, using the inverse of the squared residuals as the weights. SUP = sustainability performance; CEP = circular economy practices; SIZE = firm size; AGE = firm age; IP = internal pressure; EP = external pressure.

Finally, we test the moderating effects of firm size (see Tables 8 and 9). Again, we examined internal and external pressures separately. In the case of internal pressure (H5), we did not observe any significant effect, as shown in Table 8. However, regarding external pressures (H6), the effect was positive and significant ($\beta=0.283$, $p<0.01$), as shown in Table 9.

Table 8. The moderating role of firm size on the relationship between IP and CEP

Dependent variable: CEP						
	(1)	(2)	(3)	(4)	(5)	(6)
IP	0.226 (0.300)	0.255 (0.305)	0.161 (0.278)	0.126 (0.279)	0.0963 (0.277)	-0.00601 (0.106)
SIZE	0.146 (0.432)	0.207 (0.448)	0.0502 (0.408)	0.00474 (0.409)	0.0484 (0.406)	-0.174 (0.171)
IP*SIZE	-0.0181 (0.141)	-0.0351 (0.145)	-0.0104 (0.132)	0.00293 (0.133)	-0.0106 (0.131)	0.0541 (0.0524)
AGE		0.130 (0.242)	0.0809 (0.220)	0.0582 (0.220)	0.0397 (0.218)	0.00961 (0.0249)
SUP			0.633*** (0.125)	0.574*** (0.134)	0.539*** (0.134)	0.552*** (0.0362)
ECP				0.189 (0.159)	0.157 (0.158)	0.136*** (0.0286)
EP					0.157* (0.0849)	0.138*** (0.00772)
constant	1.986** (0.876)	1.727* (1.001)	-0.101 (0.979)	-0.363 (1.002)	-0.543 (0.996)	-0.0639 (0.340)
N	124	124	124	124	124	124

Note: Standard errors are in parentheses. * p<0.1 ** p<0.05 *** p<0.01. Models 1 through 5 employed Ordinary Least Squares (OLS) regression, while Model 6 utilized Weighted Least Squares (WLS) regression, using the inverse of the squared residuals as the weights. CEP = circular economy practices; SIZE = firm size; AGE = firm age; SUP = sustainability performance; ECP = economic performance; IP = internal pressure; EP = external pressure.

Table 9. The moderating role of firm size on the relationship between EP and CEP

Dependent variable: CEP						
	(1)	(2)	(3)	(4)	(5)	(6)
EP	-0.279 (0.282)	-0.282 (0.283)	-0.316 (0.261)	-0.357 (0.262)	-0.375 (0.263)	-0.414*** (0.0477)
SIZE	-0.857* (0.490)	-0.849* (0.492)	-0.849* (0.453)	-0.907** (0.454)	-0.913** (0.455)	-0.963*** (0.0695)
EP*SIZE	0.284** (0.136)	0.284** (0.137)	0.261** (0.126)	0.275** (0.126)	0.270** (0.127)	0.283*** (0.0221)
AGE		0.0919 (0.226)	0.0660 (0.208)	0.0485 (0.208)	0.0347 (0.209)	0.0414 (0.0368)
SUP			0.581*** (0.123)	0.521*** (0.132)	0.520*** (0.132)	0.503*** (0.0216)
ECP				0.195 (0.155)	0.189 (0.155)	0.189*** (0.0185)
IP					0.0670 (0.0774)	0.0887*** (0.0131)
constant	3.570*** (0.997)	3.460*** (1.037)	1.620 (1.032)	1.377 (1.047)	1.335 (1.050)	1.469*** (0.192)
N	124	124	124	124	124	124

Note: Standard errors are in parentheses. * p<0.1 ** p<0.05 *** p<0.01. Models 1 through 5 employed Ordinary Least Squares (OLS) regression, while Model 6 utilized Weighted Least Squares (WLS) regression, using the inverse of the squared residuals as the weights. CEP = circular economy practices; EP = external pressure; IP = internal pressure; AGE = firm age; SIZE = firm size; SUP = sustainability performance; ECP = economic performance.

To explore whether larger or smaller SMEs exert a stronger influence, Figure 2 plots our interaction terms with external pressure on the x-axis and circular economy practices on the y-axis, while firm size serves as the moderating variable distinguishing the lines (1=micro; 2=small; 3=medium). Observing the plot, the simple slope of external pressure at “micro-size” firms is almost flat but becomes positive for “small” and “medium” firms. We observe the strongest association between external pressure and circular economy practices at the highest level of firm size (medium). Overall, our results suggest that firm size moderates the positive relationship between external stakeholder pressure and circular economy practices, with a more pronounced influence on larger SMEs than on smaller ones.

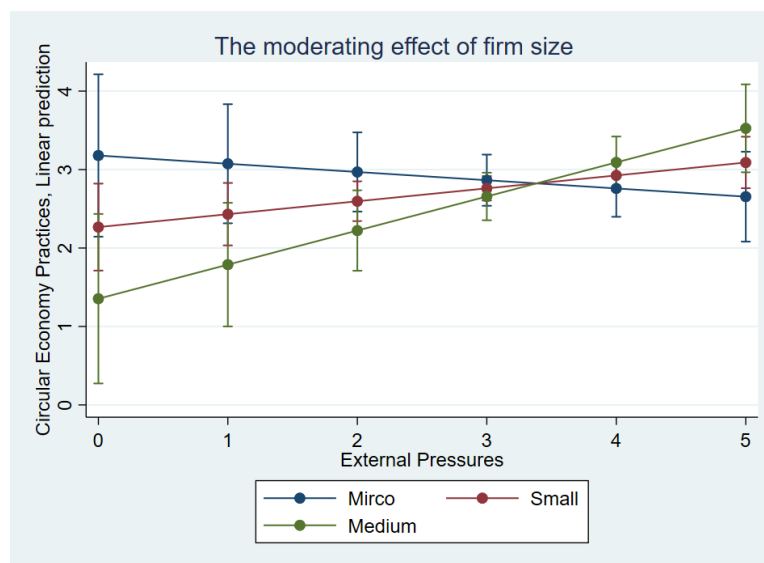


Figure 2. Interaction between firm size and external pressure on Circular economy practices

Note: The above shown plot is based on OLS regression.

DISCUSSION

The findings of this study provide an analysis that not only aligns with the existing literature but also extends our understanding of the dynamics influencing the adoption of CE practices among SMEs. Prior studies have consistently emphasized the critical role of stakeholder pressure in driving CE initiatives. For instance, Ahmadov, Gerstlberger, and Rahman, (2024), Baah et al. (2023), and Jakhar et al. (2019) all studies highlight how stakeholder pressure shapes the adoption of CE practices. This study corroborates these findings by showing that internal and external stakeholder pressures significantly influence CE practices, thereby supporting hypotheses H1 and H2. This is consistent with the arguments of Genovese et al. (2017) and Govindan and Hasanagic (2018), who emphasized the vital role of external stakeholder pressure in encouraging CE practices. These results can be effectively interpreted through the lens of stakeholder theory, which underscores the importance of both internal and external stakeholders in shaping organizational practices and outcomes.

Furthermore, the current study extends the literature by demonstrating the positive impact of CE practices on firm-level economic and sustainability performance, supporting hypotheses H3 and H4. This aligns with previous research indicating that CE practices can lead to improved financial outcomes owing to cost savings from resource efficiency and the creation of competitive advantages (Feng & Goli, 2023; Mazzucchelli et al., 2022). Additionally, the findings are consistent with those of Khan et al. (2023) and Zhou et al. (2023), who highlighted that CE practices, mediated by sustainable supply chain practices and green logistics management, positively affect sustainability performance.

A critical contribution of this study is the detailed examination of firm size as a moderating factor. While prior research has indicated that firm size influences the integration of CE practices in response to stakeholder pressures (Ali & Johl, 2023; Farooq et al., 2021; Latip et al., 2022), this study provides empirical evidence that firm size significantly moderates the impact of external stakeholder pressure on CE practices but not internal pressure. This nuanced finding extends the work of Courrent and Omri (2022) and Vidal et al. (2023), who noted the varying levels of stakeholder pressure faced by SMEs of different sizes. The results reveal that larger SMEs experience a stronger positive impact of external pressure on CE adoption, whereas the influence on smaller firms is less pronounced.

The study's findings on the moderating effects of firm size also align (González-Rodríguez et al., 2019), highlighting the importance of distinguishing between internal and external stakeholder pressures. The interaction plot illustrating that the influence of external pressure is more significant in small and medium-sized firms compared to micro-sized firms offers a refined understanding of how firm size affects the adoption of CE practices.

The practical implications of these findings are substantial for SMEs and policymakers aiming to enhance the adoption of CE practices. Given the significant influence of internal and external stakeholder pressures, SMEs should strategically engage with stakeholders to foster a supportive environment for CE initiatives. Internally, this involves actively involving employees, owners, and shareholders in achieving sustainability goals and practices. Externally, SMEs should prioritize building strong relationships with customers, suppliers, and regulatory bodies to align their CE efforts with broader environmental expectations and regulations. Additionally, the moderating effect of firm size suggests that tailored strategies are necessary. Larger SMEs should leverage their greater resources and capabilities to respond more effectively to external pressures, while smaller SMEs might need targeted support and resources to overcome barriers to CE adoption. Policymakers can facilitate this by providing incentives and support mechanisms that account for firm size and fostering collaborative platforms where SMEs can share best practices and innovations in CE. This approach not only enhances the sustainability and competitiveness of SMEs but also contributes to broader environmental and economic goals.

CONCLUSION

The current study extends our understanding of the dynamics influencing the adoption of CE practices among SMEs, reinforcing and expanding the existing literature. Previous studies have consistently highlighted the critical role of stakeholder pressure in driving CE initiatives. This study goes further by distinguishing between internal and external stakeholder pressures and assessing their individual impacts on CE practices. Our findings demonstrate that both internal and external pressures significantly influence the adoption of CE practices, providing a more nuanced understanding of stakeholder dynamics while also resonating with the framework of stakeholder theory.

Moreover, this study adds depth to the current body of knowledge by examining the moderating role of firm size in the relationship between stakeholder pressures and the adoption of CE practices. The findings indicate that, while firm size does not significantly affect the impact of internal pressures, it moderates the relationship between external pressures

and CE practices. This study's contribution lies in shedding light on the contextual aspect of firm size within SMEs, challenging the common view that SMEs are a homogeneous group. From the perspective of the RBV, larger SMEs that are well equipped with resources are better positioned to leverage external stakeholder pressures to enhance their CE practices, emphasizing that size matters and highlighting the need for differentiated strategies based on firm size.

While this study offers insights into the adoption of CE practices among different categories of SMEs, it is not without its limitations. First, the sample may not be fully representative of the broader population of SMEs in Baltic countries, which limits the generalizability of the findings. Second, the study's cross-sectional design does not allow for the establishment of causal relationships between stakeholder pressure, firm size, and CE practices, limiting the ability to determine the directionality or temporal sequence of these interactions. Additionally, this research focused primarily on the influence of stakeholder pressures and firm size, neglecting other potentially relevant factors such as organizational culture and industry-specific dynamics. This study also employed a quantitative approach, which may limit the depth of understanding of the underlying mechanisms driving CE adoption.

Future research could address these limitations by employing qualitative methods to explore the nuances of stakeholder influence and firm-level dynamics in more detail. For instance, interviews and case studies can provide a deeper understanding of how internal and external stakeholder pressures uniquely impact firms of different sizes. In addition, future research should consider more diverse samples across various regions and industries to validate these findings. Longitudinal studies can provide insights into the long-term effects of CE practices on firm performance and sustainability outcomes. Additionally, investigating the role of other contextual factors such as industry characteristics and regulatory environments could enhance our understanding of the complex interplay between stakeholders and CE adoption in SMEs. By addressing these aspects, future research could provide a more comprehensive view of the determinants and effects of CE practices across different categories of SMEs.

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Biographical notes

Tarlan Ahmadov is a PhD candidate at Tallinn University of Technology, Department of Business Administration and a visiting researcher at RISE, Research Institute of Sweden. His research revolves around small and medium-sized enterprises transitioning to circular economy models. His work seeks to contribute to an eco-friendlier business landscape, understanding various stakeholders' interests and helping SMEs to navigate the transition process.

Susanne Durst is a Professor of Management at Reykjavik University, Iceland. Her research focuses on risks related to knowledge, responsible knowledge management, business development, and digital transformation in smaller entrepreneurial organizations. She aims to advance sustainable and ethical business practices in the digital age.

Wolfgang Gerstlberger is a professor at Tallinn University of Technology, and his interests and projects revolve around sustainable innovation, Industry 4.0, and the development of emerging technology clusters. His work aims to uncover insights that can inform strategies for fostering sustainable development and leveraging emerging technologies for industrial advancement.

Quang M. Nguyen is a PhD candidate in the Department of Economic Analysis at the University of Valencia. His research concentrates on enterprise surveys and the impact of various policies on firm performance. Currently, he is evaluating the effects of privatization on firm performance using a staggered difference-in-differences approach.

Authorship contribution statement

Tarlan Ahmadov: Introduction, Literature Review, Research Concept, Data Gathering. **Susanne Durst:** Conceptualising, Supervising, Review and Editing. **Wolfgang Gerstlberger:** Review and Editing, Data Gathering, Validation. **Quang M. Nguyen:** Data Analysing, Writing – Review & Editing.

Conflicts of interest

The authors declare no competing interests.

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Capital structure specificity in knowledge-intensive industries: A comparative study of EU countries

Magdalena Gostkowska-Drzewicka¹ , Julia Koralun-Bereźnicka² 

Abstract

PURPOSE: This paper aims to examine and compare the capital structure patterns and financial decision-making determinants of knowledge-based firms and traditional industries in selected EU countries over the period 2000–2023. The study seeks to uncover sector-specific features, focusing on the unique financial behaviors of knowledge-intensive enterprises compared to their traditional counterparts. It also explores how factors such as asset structure, profitability, and growth opportunities influence capital structure decisions within these industries, thus providing implications for financial management in innovation-driven sectors. **METHODOLOGY:** The methodology involves analyzing data from 12 EU countries, categorized by industry (sectors M and J for knowledge-based firms and other sectors for traditional firms) and firm size. The research applies panel data modeling to evaluate the differences and influences on capital structure within these groups. **FINDINGS:** The study reveals that knowledge-based firms exhibit distinct capital structure characteristics, including a higher reliance on intangible assets and lower ratios of long-term debt compared to traditional firms. Specifically, the findings indicate that intangible assets are positively correlated with total and long-term debt in knowledge-based firms, meaning that an increase in intangible asset value is associated with a corresponding increase in total and long-term debt levels. This relationship aligns with the modified pecking order theory, which posits that firms prioritize funding sources based on their perceived cost and risk. The determinants of capital structure – such as profitability and growth opportunities – also demonstrate differing impacts, revealing the unique financial strategies employed by knowledge-based firms. **IMPLICATIONS:** This research highlights the importance of adapting financial strategies to the specific needs of knowledge-based firms, which often face unique challenges due to their reliance on intangible assets. Policymakers can use these findings to design targeted financial policies that support the growth and sustainability of innovation-driven enterprises, such as by offering incentives for intangible asset financing or by reducing barriers to accessing long-term debt. For practitioners, the insights highlight the need to align financial decision-making with sector-specific characteristics to optimize capital structure and drive competitive advantage. **ORIGINALITY AND VALUE:** This research makes a unique contribution by providing one of the first comparative analyses of capital structure determinants across knowledge-based and traditional firms in multiple EU countries over an extended timeframe (2000–2023). Unlike prior studies, which often focus on individual sectors or countries, this study offers a comprehensive and cross-sectoral perspective, enriching the understanding of how financial theories operate in diverse economic and institutional contexts. By addressing the financial behaviors of knowledge-intensive firms, the research bridges a critical gap in the literature and informs both academia and practice.

Keywords: capital structure, knowledge-based firms, traditional industries, panel data regression, EU countries, innovation-driven enterprises, modified pecking order theory, sector-specific analysis

¹ Magdalena Gostkowska-Drzewicka, Ph.D., Department of Corporate Finance, Faculty of Management, University of Gdańsk, ul. Armii Krajowej 101, 81-824 Sopot, Poland, e-mail: magdalenagostkowska-drzewicka@ug.edu.pl (ORCID: <https://orcid.org/0000-0002-4383-7711>).

² Julia Koralun-Bereźnicka, Ph.D., Assistant Professor, Department of Corporate Finance, Faculty of Management, University of Gdańsk, ul. Armii Krajowej 101, 81-824 Sopot, Poland, e-mail: julia.koralun-bereznicka@ug.edu.pl (ORCID: <https://orcid.org/0000-0003-4498-0381>).

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INTRODUCTION

A company can survive in a competitive market only through continuous growth and development. Business growth is a quantitative phenomenon that involves expanding resources to scale operations, leading to an increase or maintenance of market share. In contrast, business development is qualitative and entails changes through the introduction of product, technological, and organizational innovations. Innovation is seen as a key factor in a company's success (Dash, 2023), as it provides a competitive advantage by implementing new and improved methods of operation. This involves the deliberate application of ideas, processes, products, or procedures that are new to the company, aiming to enhance its functioning (West, 2000). Górska-Warasewicz (2024) emphasizes that innovation leads to improved business performance. According to Li's (2024) research, innovation ability is an important factor in mitigating financial distress. The author proved that companies in financial distress that exhibit higher innovation ability tend to achieve better operational performance in the future. Drucker (1992) argues that innovations are a unique tool of entrepreneurship, enabling resources to create new wealth opportunities, primarily in the socio-economic sphere. Porter (1998) highlights that innovations are technological and represent better methods and ways of manufacturing. They can involve products, processes, new marketing approaches, and new distribution solutions.

The science sector plays a crucial role in the development of innovation. Therefore, an adequate research and development (R&D) base is an essential element of the environment for an innovation-oriented enterprise. R&D activities are defined as creative work undertaken systematically to increase knowledge resources and to create new applications for existing knowledge. These activities are always directed towards new discoveries based on original concepts and their interpretations. The goal of R&D activities is to achieve outcomes that can be commercialized (OECD, 2015). The specific role of R&D lies in creating unique knowledge that allows a company to gain a competitive advantage, ensuring its long-term development. Knowledge is an intangible resource, invisible and entirely dependent on the attitude and qualifications of the company's human capital (Skoczylas-Tworek, 2014). Entities for which knowledge forms the basis of their operations are called knowledge-based enterprises. These companies produce and sell goods and services developed through advanced technologies resulting from R&D work. Therefore, they convert scientific knowledge into new technology, which they then commercialize (Oakey et al., 1988).

Knowledge-based enterprises are a diverse group of entities, differing in internal aspects (e.g., strategy, organization, or market experience) and external aspects, such as operating in sectors with varying levels of technological development. A common characteristic of these entities is their high capital intensity (Giudici & Paleari, 2000; Coleman & Robb, 2012), stemming from a large share of R&D expenditures, a significant proportion of highly qualified employees often with research experience, and a focus on innovative products. This is reflected in the value of their intangible assets, which are the main source of value creation for knowledge-based firms (Martínez-Torres, 2014). Thus, knowledge is the foundation of their operations and can be seen as the most important strategic intangible resource of the enterprise and a source of competitive advantage (Sytnik & Kravchenko, 2021).

Knowledge-based entities primarily operate in sectors that require the use of advanced technological solutions. Transition into the knowledge economy manifests in the growing importance of intangible versus tangible assets (Rabinovich, 2023). Intangible assets have become a key factor in the operational efficiency of many enterprises. Moreover, the unprecedented improvement of new technologies is increasingly perceived as the source of future economic development and potentially a new engine to reverse the productivity slowdown observed in many OECD economies (Demmou et al., 2019). It is emphasized that knowledge-based enterprises are particularly important for peripheral regions and economies with marginal global significance. Socio-economic transformations occurring in emerging markets increase the importance of knowledge as a key resource for companies (Paredes-Chacín et al., 2024). This is particularly relevant as some of the countries analyzed in our study (i.e., Croatia, Hungary, and Slovakia) are classified as emerging markets. Moreover, through knowledge, companies can overcome market entry barriers and unfavorable competitive conditions faced by traditional businesses, such as those producing basic consumer goods or engaged in construction (Gorman et al., 2005).

However, knowledge-based firms cannot be identified solely with areas of the economy related to advanced technologies. Defining these entities clearly is thus challenging. These firms can be categorized as those that utilize unique, innovative, and technologically advanced solutions developed through higher-than-average R&D investments in their sector (Chapple et al., 2004). According to another definition, they are companies that incur above-average R&D expenditures in their country and have a higher proportion of scientific and technical staff in their employment structure

compared to other firms (Neville & Lucey, 2022). Additionally, a characteristic feature of knowledge-based enterprises is the rapid diffusion of innovations and high investment risk. The previously mentioned high capital intensity in this sector is directly related to investment risk, necessitating the acquisition of substantial financial resources. This issue is particularly challenging for knowledge-based start-ups. Innovation advancements and digital technologies strongly influence changes in firms' strategic choices, so there is a need to reconsider factors influencing corporate financing decisions, especially in high-tech sectors (Dobusch & Kapeller, 2018). Therefore, it can be concluded that the capital structure of knowledge-based enterprises is unique due to the nature of their activities.

Butzbach and Sarno (2019) conclude that a firm's capital structure preferences vary with its life cycle, which determines the availability of financial resources and the cost of capital. Newly established knowledge-based enterprises, like other firms in the early stages of their life cycle, face significant challenges in accessing financing. Capital raised through public offerings is practically unattainable for such entities because it requires an established history and adequate financial stability. Moreover, younger firms are less well-known than their older and more experienced competitors (Faulkender & Petersen, 2006). Even older knowledge-based firms can struggle to secure debt financing, both in the form of bank loans and bond issuance, due to the low proportion of tangible assets in their asset structure. These financial constraints prevent such firms from fully leveraging their potential to undertake innovative investments (He & Tian, 2018). As previously mentioned, innovative enterprises possess significant intangible assets, which can offer substantial future development opportunities. However, these assets are not effective as debt collateral because their unique nature makes them difficult to value and sell for use in another company (Revest & Sapio, 2012).

On the one hand, the prevailing view in the literature is that knowledge-based enterprises, especially high-tech firms, may have difficulties obtaining debt financing, whether in the form of bank loans or bond issuance (Colombo & Grilli, 2007). For this reason, innovative firms are more dependent on equity than debt financing (Falato et al., 2018). On the other hand, research by Gorman et al. (2005) indicates that the procedures used by lenders to assess knowledge-based firms do not differ significantly from those used for traditional companies. Also, Brown and Lee (2019) challenged the assumption that innovative firms have problems with credit access. Based on the survey of 8000 UK SMEs in the period following the financial crisis of 2008, they concluded that there is no difference in access to external finance for knowledge-based SMEs and other companies.

The literature includes numerous studies on the capital structure of knowledge-based enterprises. These studies cover various countries and present diverse approaches to the capital structure of entities in knowledge-intensive sectors. A significant portion of these analyses focuses on firms in the USA (e.g., Yang, 2022; Habibniya et al., 2022; Na, 2021). Other studies examine the capital structure of knowledge-based firms in specific countries such as Japan (Che-Yahya et al., 2022) and Ireland (Neville & Lucey, 2022). Only a few analyses address the financing patterns of innovative enterprises across multiple countries (e.g., Castro et al., 2015). Additionally, available studies often pertain to relatively distant research periods. For this reason, these studies overlook recent economic developments, particularly in the area of finance, which may significantly affect the capital structure of knowledge-based enterprises.

Research gaps are evident not only in the limited geographical or subjective scope of previous studies but also in the context of the analyzed capital structure factors and their connections with knowledge-based activities. Most studies focus on specific factors, presenting a narrow approach to understanding the determinants of capital structure. For instance, Yang (2022) examines the impact of commercial property ownership in the U.S. office market on the capital structure of telecommunications companies during an economic downturn. Similarly, Na (2021) analyzes the influence of an innovative firm's proprietary information on its debt financing preferences. Duan (2023) investigates how the threat posed by Non-Practicing Entities (NPEs), colloquially known as patent trolls, affects capital structure decisions in high-tech firms. In contrast, Thakor and Lo (2022) explore the interaction between product market competition, R&D investment, and the financing choices of R&D-intensive firms in the development of innovative products.

Thus, there is a lack of comprehensive studies on comparative analyses of capital structure factors in knowledge-based firms and entities from other traditional sectors on an international scale. First, the research gap involves determining whether significant differences exist in the capital structure of knowledge-based enterprises compared to other entities in selected European Union countries. To the best of our knowledge, the only research that presents the capital structure of both groups of enterprises in a larger group of countries in a cross-sectional way was conducted by Castro et al. (2015). However, this analysis covers a relatively distant period, i.e. 2000-2012, and focuses only on highly developed countries in Western Europe.

Second, it is relevant to identify and compare the impact of capital structure factors on firms in both groups. As previously mentioned, most of the available research adopts a narrow approach, focusing on only a limited set of factors. Only a few studies analyse a broader set of variables (e.g., Castro et al., 2015; Serrasqueiroa et al., 2016; Grabińska et al., 2021; Spitsin et al., 2022; Kim & Pukthuanthong-Le, 2008). Third, the research period covers the most recent available data, i.e., 2000–2023.

Consequently, the aim of this study is to identify and compare the financing patterns in sectors containing knowledge-based enterprises and traditional sectors in selected EU countries over the period 2000–2023. This paper aims to identify sector-specific characteristics by examining the distinct financial behaviors of knowledge-intensive enterprises in comparison to traditional firms. It investigates the impact of factors such as asset structure, profitability, and growth opportunities on capital structure decisions within these industries, offering insights into financial management in innovation-focused sectors.

This article contributes to the literature on capital structure and innovative entrepreneurship. First, it verifies the hypothesis regarding the specificity of capital structure and its determinants in knowledge-based enterprises. Second, it tests the hypothesis on the differing impact of capital structure factors on the debt levels of knowledge-based firms versus traditional businesses. Consequently, it provides evidence of the relationship between the unique nature of knowledge-based enterprises and their capital structure.

The structure of the article is as follows. First, a literature review is presented, consisting of a description of the theoretical foundations of capital structure formation and a review of empirical studies on the financing patterns of knowledge-based firms. Based on this review, research hypotheses are formulated. The methodology section describes the data scope and the research procedure based on panel models. Next, the research results are presented along with a discussion of the obtained findings. The article concludes with a summary that includes practical and theoretical implications, research limitations, and suggested directions for future research.

LITERATURE REVIEW

Theoretical background

Two opposing approaches dominate capital structure theories: the trade-off theory and the pecking order theory. These theories provide a foundational lens for understanding the financing behaviors of firms, including those in knowledge-intensive industries. According to the trade-off theory, firms shape their capital structure by balancing the costs and benefits of debt (Rajan & Zingales, 1995). The starting point for this theory is taxation (Modigliani & Miller, 1963; Fama & French, 1998) and bankruptcy costs (Opler & Titman, 1994). Tax savings from debt financing are associated with the use of the tax shield, which increases after-tax profits. However, when a company defaults on its obligations and faces financial difficulties, it leads to increased bankruptcy risk and associated costs. Therefore, capital structure should be a compromise between the current tax benefits of increased debt and the costs of higher financial leverage. This allows for the determination of an optimal capital structure, which is a specific combination of debt and equity (Myers, 1977). This optimal structure varies across industries due to differences in technological requirements, asset structures, and creditor trust, as reflected in the sector-specific average debt levels.

Individual sectors exhibit different financing patterns, which can be explained by trade-off theory, as firms strive to achieve the optimal capital structure mentioned above. This optimal level is assumed to be the average debt ratio or the median financial leverage for a given sector, reflecting the sector's conditions. The tendency of firms within the same sector to have similar capital structures results from their capital needs, determined by the technologies they use, asset structure, type of activity, and the trust of creditors, which in turn affects credit availability. Therefore, the median debt level in a sector is a measure of financial risk. Furthermore, empirical research indicates that being part of a sector with a higher average debt ratio is associated with a greater debt share in the capital structure of individual enterprises (Jõeveer, 2013).

The second theory is based on the information asymmetry between corporate insiders and external investors (Myers & Majluf, 1984; Myers, 1984). Castro et al. (2015) and Tagliatalata and Mina (2024) demonstrated that information asymmetry is the most significant factor limiting debt in knowledge-based firms. The pecking order theory explains firms' preferences regarding the use of different financing sources. The order is as follows: first, internal sources such as retained earnings and cash surpluses along with short-term financial assets are used. After these are exhausted, firms turn to external sources. Initially, they use bank loans and borrowings, then decide to issue bonds, and only as a last resort,

issue equity. The literature emphasizes that the age of the firm plays a significant role in shaping the capital structure of knowledge-based firms. The aforementioned order of financing sources is mainly characteristic of older entities that can generate adequate internal resources and, therefore, have lower levels of debt (López-Gracia & Sogorb-Mira, 2008; Castro et al., 2015). In contrast, the hierarchy of financing sources for innovative enterprises at early development stages is usually different. Entities focused on R&D and possessing highly qualified staff tend to rely less on debt after exhausting internal funds and instead rely more on equity financing through share issuance. This means these firms follow a modified pecking order theory (Minola et al., 2013; Serrasqueiroa et al., 2016; Cosh et al., 2009). According to this concept, after internal funds are exhausted, firms issue equity to obtain capital due to the limited availability of debt.

Knowledge-based firms face unique challenges that complicate their capital structure decisions. These firms typically rely heavily on intangible assets, such as intellectual property and R&D outputs, which are difficult to use as collateral. Consequently, traditional debt financing is less accessible to them (Revest & Sapio, 2012). High R&D intensity, particularly in the early stages, exacerbates information asymmetry and financial distress risks (Hall, 2002), further limiting their ability to secure debt financing. As a result, knowledge-intensive firms often turn to equity issuance despite its high cost and potential signaling concerns for shareholders (Myers & Majluf, 1984; Ross, 1977).

Empirical studies on the capital structure of knowledge-based firms and hypotheses development

Firms within a given sector face not only financial risk but also industry-specific risk. This risk is related to the intensity of competition within the sector, the flexibility and variability of demand, production characteristics—particularly capital intensity—and the diversity of product assortment. The combined impact of these factors influences the volatility of operating results for firms within that sector. Furthermore, higher industry-specific risk decreases firms' propensity to incur debt and undermines creditor confidence (Palazzo, 2019).

Most available studies emphasize that knowledge-based firms are characterized by high capital intensity, particularly in the early stages of their life cycle. The primary sources of this capital intensity are investments in research and development (R&D) and marketing, which are essential components of any innovative project and require substantial financing. Consequently, these entities must seek large amounts of financial resources, both equity and debt. However, the capital structure of knowledge-based enterprises is not homogeneous. The demand for financial resources from various sources is primarily influenced by specific characteristics of knowledge-based entities, especially the high proportion of intangible assets and significant R&D expenditures (Hogan & Hutson, 2005; Hyytinen & Pajarinen, 2005).

Knowledge-based enterprises may have difficulty obtaining debt financing, both in the form of bank loans and bond issuance, due to the low proportion of tangible assets in their asset structure (Colombo & Grilli, 2007). As previously mentioned, these firms possess significant intangible assets. However, these assets are not effective collateral for debt because their unique nature makes them difficult to sell for use in another company (Revest & Sapio, 2012; Brierley, 2001). Moreover, firms with substantial intangible assets exhibit higher levels of information asymmetry (Hogan & Hutson, 2005), stemming from the difficulty in valuing these assets, creating an additional barrier to obtaining debt financing (Harris & Raviv, 1991). This effect is further confirmed by the negative impact of intangible assets and growth opportunities on financial leverage, which leads to reduced debt levels (Castro et al., 2015). However, as shown by Tagliatalata and Mina (2024), the type and order of financing sources depend on the degree of information asymmetry associated with R&D activities, capital equipment, and the introduction of new products and processes specific to each firm. Furthermore, high R&D intensity, especially in early-stage firms, signals significant future growth potential, which is associated with high risk and increased expected financial distress costs (Hall, 2002). This significantly limits access to credit, as banks are reluctant to finance such firms. Consequently, high R&D expenditures lead to lower financial leverage.

High fixed costs associated with the salaries of highly skilled scientific and technical staff, along with other R&D expenditures, represent a significant financial burden for knowledge-based firms. As previously mentioned, due to difficulties in obtaining debt and the depletion of internal funds, these firms often resort to issuing equity. According to signaling theory, such actions are negatively perceived by existing shareholders as they indicate financial difficulties (Myers & Majluf, 1984). In such situations, firms incurring losses attempt to attract new shareholders (Ross, 1977). This action aims to reduce the burden of these losses on current shareholders. Moreover, issuing equity is viewed negatively due to the additional costs associated with the issuance. Therefore, it is assumed that an increase in equity capital through share issuance signals a future decline in the firm's value.

For these reasons, the pecking order theory assumes that entities with substantial intangible assets are less leveraged than other enterprises. Similarly, according to the trade-off theory, firms with significant intangible assets exhibit lower debt

levels (Rajan & Zingales, 1995). These assets are more likely to lose value when the firm's financial situation deteriorates, thus increasing expected bankruptcy costs (Myers, 1984).

On the other hand, the pecking order theory can explain the opposite relationship between capital structure and intangible assets in knowledge-based enterprises. The significant financial needs of these firms and the information asymmetry associated with their intangible assets increase the cost of equity capital from share issuance (Frank & Goyal, 2009). Consequently, this leads to higher financial leverage, as these entities will prefer cheaper debt capital. Moreover, substantial intangible assets may provide future development opportunities associated with a competitive advantage based on knowledge (Sytnik & Kravchenko, 2021). Neville and Lucey (2022) documented the positive impact of intangible assets on the value of a firm's generated income, which can serve as an additional incentive for creditors. Research by Gorman et al. (2005) indicates that the procedures used by creditors to assess knowledge-based firms and traditional firms do not differ significantly, further confirming the positive relationship between intangible assets and debt. Additionally, Na (2021) demonstrated that the primary factor determining the choice of financing sources in innovative American firms is their patents. These firms have specific debt preferences, initially opting for public debt, followed by private placements and bank loans. However, as these entities become more competitive, their financing patterns begin to reverse.

In practice, a knowledge-based enterprise may possess not only a significant proportion of intangible assets but also valuable tangible assets that can be used as debt collateral. Yang (2022) showed that American telecommunications firms with substantial commercial real estate assets have higher debt levels. His research indicates that this relationship was particularly significant during the economic recession, where real estate, used as collateral, significantly expanded financing opportunities. According to Habibniya et al. (2022), American telecommunications firms exhibit exceptionally high debt ratios.

Knowledge-based firms are under constant pressure for continuous development throughout their life cycle. As their fundamental resource, knowledge is continuously accumulated by these entities. However, due to technological obsolescence, these firms must periodically invest in renewing their assets. Therefore, knowledge-based enterprises, whose products have short life cycles and are accepted by the market, exhibit high growth rates throughout their life cycle (Kazanjian, 1988). If a firm fails to renew its technologies, its growth rate would drop to the market's average growth rate, leading to maturity and eventual elimination by competitors. According to the trade-off theory, firm age promotes higher leverage because older firms have better market reputations. In contrast, the pecking order theory explains the opposite relationship. Older firms show higher profitability due to their ability to generate and accumulate more profits (Frank & Goyal, 2009). However, due to the need for continuous development and significant growth potential, knowledge-based firms are compelled to seek additional financing sources to cover technological renewal costs, as internal funds may be insufficient. Consequently, this leads to increased financial leverage.

The aforementioned characteristics of knowledge-based firms affect all areas of their operations. Therefore, it is assumed that the capital structure of these firms, as well as its determinants, are primarily shaped by the sector effect.

The trade-off theory explains the lower debt levels in knowledge-based firms by highlighting the heightened bankruptcy costs associated with intangible assets, which tend to lose value quickly in financial distress (Myers, 1984). Meanwhile, the pecking order theory offers a contrasting perspective, suggesting that the high financial needs and growth potential of such firms may lead to greater reliance on debt, despite their intangible-heavy balance sheets. For instance, intangible assets can generate future growth opportunities and income streams, incentivizing creditors to extend financing (Neville & Lucey, 2022).

Drawing from the above theoretical insights, the capital structure of knowledge-intensive firms is expected to differ significantly from that of firms in other industries due to their reliance on intangible assets, high R&D expenditures, and sector-specific risks. Moreover, the determinants of capital structure, such as growth potential and asset structure, likely influence these firms differently. These theoretical arguments form the basis for the following research hypotheses:

H1: The capital structure metrics and their firm-specific determinants are significantly different in knowledge-based firms than in firms from other industries.

H2: The impact of capital structure determinants in knowledge-based firms varies from that in other industries.

METHODOLOGY

Data characteristics

The data used for the empirical section of this study originates from the BACH database (BACH, 2023), which offers standardized annual financial statistics for non-financial companies across twelve EU nations: Austria (AT), Belgium (BE), Germany (DE), Spain (ES), France (FR), Croatia (HR), Hungary (HU), Italy (IT), Luxembourg (LU), Poland (PL), Portugal (PT), and Slovakia (SK). These countries not only belong to different geographical regions but also exhibit varying levels of economic and innovation development, as shown in Figure 1 (EUROSTAT, 2024).

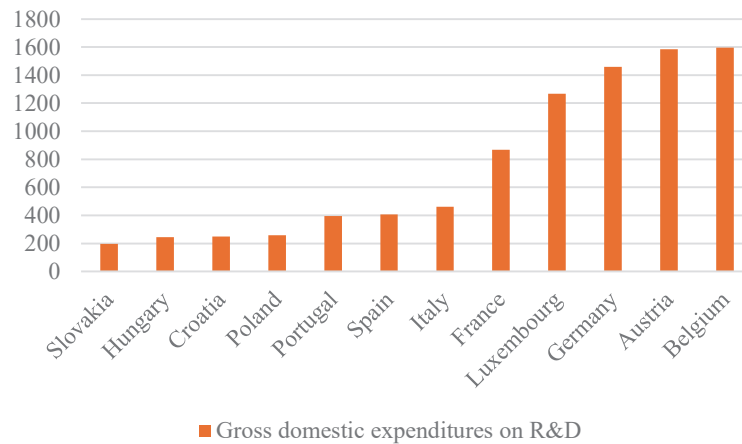


Figure 1. Gross domestic expenditures to the GDP in selected European countries in 2022 (Euro per inhabitant)

In 2022, the highest gross domestic expenditures on R&D among the selected European countries were recorded in Belgium and Austria, with these countries allocating €1,585.5 and €1,597 per capita, respectively. It is remarkable that, among the remaining countries, only Western European nations were included in the group with high intramural R&D expenditures.

Within the analyzed group, Poland, Slovakia, Croatia, and Hungary spent less than €500 per capita on gross domestic R&D expenditures. This group also includes countries that underwent economic and political transformation in the 1990s, as well as those located in Southern Europe. Interestingly, this situation applies even to Italy, which, despite ranking among the world's wealthiest countries, exhibits relatively low R&D spending.

Poland presents a particularly unique case. In 2018, Poland became the first Central and Eastern European (CEE) economy to be promoted by FTSE Russell's index provider from Emerging Market to Developed Market status (<https://emerging-europe.com/analysis/poland-promoted-to-developed-market-status-by-ftse-russell/>). This promotion places Poland among the 25 most advanced global economies. However, as Eurostat data demonstrate, Poland remains one of the EU countries with the lowest levels of intramural R&D expenditures, reflecting a disconnect between its economic classification and its R&D investment levels, as shown in Figure 1.

In highly developed economies such as Austria, Belgium, France, Germany, and Luxembourg, most of the financial resources for R&D activities are provided by enterprises. It is important to emphasize that the value of these expenditures is significantly higher than those incurred by government institutions. As shown in Figure 2, this pattern is characteristic of Western European countries.

In contrast, countries that underwent economic and political transformation in the 1990s, as well as those classified as Southern European countries, exhibit similar trends regarding the relationship between R&D expenditures by enterprises and those by government institutions. However, in most of these cases, corporate expenditures remain very low, typically below €300 per capita, as illustrated in Figure 2 (EUROSTAT, 2024).

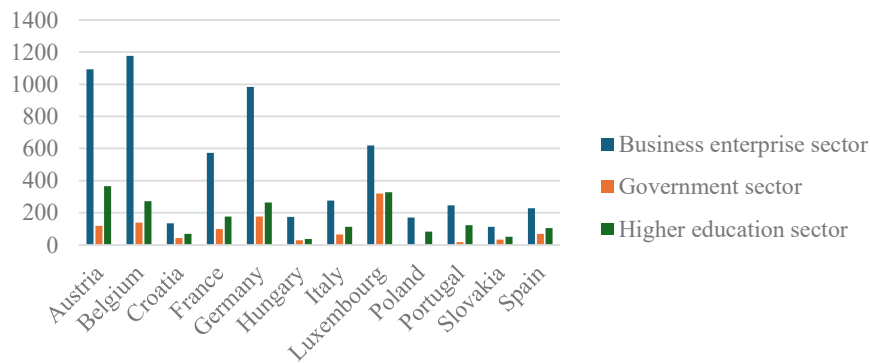


Figure 2. The value of intramural R&D expenditures in selected European countries in 2022, in a sectoral approach (Euro per inhabitant)

The BACH database, published by the European Committee of Central Balance Sheet Data Offices (ECCBSO), compiles aggregated data, including balance sheets, income statements, cash flow statements, and other financial metrics, alongside information regarding company size and sector classification. The database classifies companies according to the NACE system into 18 sectors listed in Table 1. The selection of countries was determined by the availability of data in the BACH database at the time of retrieval. All countries with comprehensive and consistent financial records within the database were included, ensuring the representativeness of the sample across the EU. However, this reliance on database coverage introduces potential limitations: not all EU countries were included, and the sample may not fully capture the diversity of economic or industrial conditions within the region. This limitation is acknowledged, and future research could benefit from expanding the scope to include additional countries and datasets.

Although this study provides insights into the financial strategies of knowledge-based firms, it also acknowledges the heterogeneity in the economic, institutional, and industrial development of the selected EU countries. The surveyed countries represent diverse levels of industrial advancement and economic conditions, which influence the operational environment for knowledge-based firms. However, the analysis does not focus explicitly on the broader conditions for the development of knowledge-based firms, such as national innovation systems or policy frameworks. Future research could address this limitation by integrating additional contextual variables reflecting the industrial and institutional structure of the surveyed countries.

Table 1. Classification of sectors according to the NACE system in the BACH database

NACE code	Sector description
A	Agriculture, forestry and fishing
B	Mining and quarrying
C	Manufacturing
D	Electricity, gas, steam and air conditioning supply water
E	Water supply, sewerage, waste management and remediation activities
F	Construction
G	Wholesale and retail trade, repair of motor vehicles and motorcycles
H	Transportation and storage
I	Accommodation and food service activities
J	Information and communication
K	Financial and insurance activities
L	Real estate activities
M	Professional, scientific and technical activities
N	Administrative and support service activities
P	Education
Q	Human health and social work services
R	Arts, entertainment and recreation
S	Other service activities

The analysis in this study covers all industrial sections available in the database, excluding the financial sector (K). The industries were categorized into two groups:

- 1) Companies from sections **J – Information and Communication** and **M – Professional, Scientific, and Technical Activities**.
- 2) The remaining industries in 12 countries and 3 size classes (small, medium, and large) during the period from 2000 to 2022.

The aim of this categorization was to extract companies involved in modern technologies and knowledge-based firms. While knowledge-based firms may be found across various sectors, the concentration of such enterprises is particularly strong within sectors **J** and **M** due to the nature of their activities, which focus on innovation, intellectual capabilities, and technological advancement. These two sectors house firms that heavily rely on intangible assets, advanced expertise, and innovative business models. Therefore, these sectors are essential for analyzing the financial behavior of knowledge-based firms due to their reliance on intellectual property, R&D, and intangible assets. By isolating these sectors, this study captures the specific financial features of innovation-driven industries.

The key sectors where enterprises operating in the field of modern technologies can be identified include:

- **Sector J – Information and Communication:** This sector covers a wide range of activities related to IT, telecommunications, programming, information services, and digital media. Companies in this sector are involved in the development, implementation, and maintenance of information and communication technologies, which include software, computer hardware, telecommunications, the internet, and digital services;
- **Sector M – Professional, Scientific, and Technical Activities:** This sector includes enterprises engaged in research and development (R&D) in the fields of technical sciences, engineering, biotechnology, nanotechnology, and other areas that can be considered technologically advanced. This sector also includes consulting and engineering services related to the implementation of new technologies.

While knowledge-based firms may be found across various sectors, it is most likely that the majority of them will be concentrated within sectors **M** and **J**. These two sectors are particularly significant in this regard as they encompass activities closely associated with innovation, scientific and technical expertise, and advanced information services. In other words, sectors **M** and **J** are most likely to house the majority of firms that are heavily reliant on intellectual capabilities and technological advancements. This concentration can be attributed to the nature of the activities within these sectors, which are integral to the development, application, and dissemination of knowledge. Table 2 provides a structured overview of the specific activities and functions within sectors **M** and **J** according to the NACE classification.

Table 2. Subsectors and activities in Sectors **M** and **J** according to NACE Classification

Sector M Subsectors	Activities in Sector M	Sector J Subsectors	Activities in Sector M
Legal, accounting, and tax consultancy activities	Legal services, accounting, bookkeeping, tax consultancy and auditing	Publishing	Includes the publication of books, magazines, newspapers, as well as digital and electronic publications. This area also encompasses the publishing of computer games.
Management and consultancy services	Business and management consulting, including strategic and organizational advice for companies	Production of films, video recordings, and television programs, recording of sound and music publishing	Includes the production of cinema films, television series, live television programs, as well as the production of music and audiobooks.
Architectural and engineering activities; technical testing and analysis	Services related to architectural and engineering design, as well as research and analysis in the field of engineering	Broadcasting	Includes broadcasting radio and television programs, over the internet, and other forms of digital distribution. Can occur at both public and private levels.
Scientific research and development	Activities related to conducting scientific research and developmental work in various fields of knowledge	Telecommunications	Involves providing telecommunication services, such as fixed-line and mobile telephony, internet access, and the transmission of data and communication in text, voice, image, or video forms.
Advertising and market research	Advertising and marketing services, including market and public opinion research	Programming and broadcasting	Refers to creating software and computer systems, including applications, databases, operating systems, and network systems.
Other specialised professional activities	Includes a wide range of specialised professional services not listed in other categories, such as photography, translations, and consultancy in specific fields	Information services	Includes services such as data processing, hosting, internet portals, the operation of internet search engines, and other services related to delivering information over the internet.

This concentration of knowledge-based firms within sectors M and J is a fundamental reason for analyzing their capital structure separately and comparing or contrasting it with the financing strategies of other industries. The distinct nature of these sectors, driven by intellectual property, innovation, and technology, often leads to unique financial needs and risk profiles that differ considerably from more traditional industries.

Knowledge-based firms, such as those involved in scientific research, technology development, and high-level consultancy, often invest heavily in R&D and rely on securing intellectual property rights. These factors necessitate a capital structure that can support long-term investment and tolerate periods of significant cash burn without immediate financial returns. Moreover, these companies may face greater volatility and uncertainty in their revenue streams, influencing their approaches to leverage and liquidity management.

In contrast, industries with more tangible assets and predictable cash flows, such as manufacturing or retail, might utilize more traditional financing strategies, often with higher levels of debt financing supported by their physical assets as collateral. Therefore, understanding the distinct capital structures in sectors M and J not only highlights the specific financial strategies needed to support innovation-driven business models but also helps in benchmarking and drawing contrasts with other sectors.

The specificity of these sectors in terms of both financing patterns as well as the proportion of intangible assets is visualised in Figure 3.

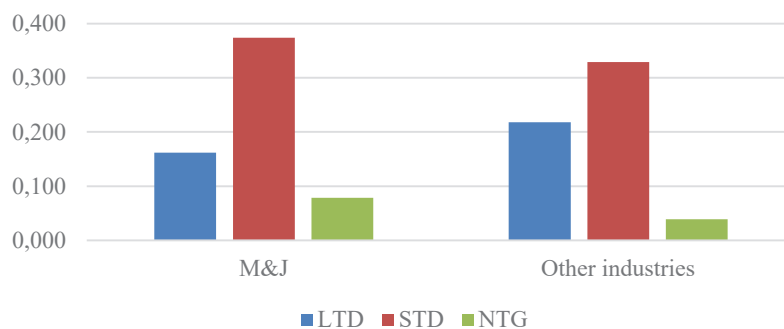


Figure 3. Capital structure ratios and the share of intangible assets in sectors M&J and other industries

Figure 3 illustrates a significant difference in the ratio of intangible assets (NTG) between the sectors M and J and other industries, with the two sectors registering a nearly double share of intangible assets compared to other industries. This suggests a pronounced focus on intangible assets such as patents, trademarks, or goodwill, which can be a reflection of a more innovative or intellectual property-driven business model. This emphasis on intangibles could indicate that the two sectors are leveraging unique business competencies or innovative products that are not as prevalent in other industries. Such a strategy might offer competitive advantages in markets where intellectual property and brand value play crucial roles in business success.

As for the debt ratios, sectors M and J exhibit a lower long-term debt ratio compared to other industries, suggesting a more conservative approach to long-term financial commitments or a reduced necessity for heavy capital investments. Conversely, it shows a higher short-term debt ratio, indicating a reliance on short-term borrowing to possibly capitalize on immediate opportunities, manage cash flows, or cover operational costs without long-term financial entanglements. These strategies reflect a focus on maintaining liquidity and flexibility, which is crucial for rapidly changing industries or those heavily investing in innovation and intangible assets.

The analyzed data is structured in three dimensions: 12 countries, 3 firm-size classes, and 23 years, with the most recent year being 2022 due to data release delays. Several dependent and explanatory variables are computed for each data point across these dimensions, as detailed in Table 3.

The set of variables used in the analysis aligns with other research in the field of finance and corporate structure, particularly in studies focusing on knowledge-based firms and innovation-driven industries. Debt ratios (total, long-term, and short-term) are standard measures in financial analysis utilized across many studies to assess leverage and financial stability, as seen in research by Rajan and Zingales (1995) and Faulkender and Petersen (2006), which analyze these ratios to discuss capital structure theories.

Asset ratios (asset fixity and intangible asset ratio) are also important for understanding the composition of assets in firms, particularly the proportion of intangible assets in knowledge-based industries, a topic explored in studies such as Erickson and Rothberg (2019). Additionally, depreciation to sales and effective tax rate metrics commonly evaluate operational efficiency and tax planning strategies. Importantly, depreciation acts as a non-debt tax shield, offering firms a way to reduce taxable income without increasing debt. Fama and French (1998) provide insights into how such tax strategies, including depreciation, influence financial decisions.

Table 3. Definition of variables employed

Variable character	Symbol	Ratio or dummy	Formula or specification	
Dependent variables	TTD	Total debt ratio	Liabilities / Assets	
	LTD	Long-term debt ratio	Non-current liabilities / Assets	
	STD	Short-term debt ratio	Current liabilities / Assets	
Explanatory variables	Firm specific variables	FXA	Asset fixity ratio	Fixed assets / Assets
		NTG	Intangible asset ratio	Nontangible assets / Assets
		DPR	Depreciation to sales ratio	Depreciation and amortization / Net turnover
		TAX	Effective tax rate	Tax on profit / Net turnover
		LCR	Liquidity current ratio	Current assets / Total assets
		AVR	Assets variability	Assets annual variation rate
		ROA	Return on assets	Net operating profit / Total assets
		SGR	Sales growth	Net turnover annual growth rate
		STF	Labor cost ratio	Staff costs / Gross value added
	Dummy variables	SIZE	Firm size dummy variables	SM, ME, LA
		CT	Country dummy variables	AT, BE, DE, ES, FR, HR, HU, IT, LU, PL, PT, SK
		IND	Industry dummy variables	A, B, C, D, E, F, G, H, I, J, L, M, N, P, Q, R, S
		YEAR	Dummy variables for years	2000–2023

Liquidity ratios (current ratio and assets variability) are crucial for liquidity management in sectors where cash flows may be unpredictable, such as technology and R&D intensive industries, aligning with studies by Myers and Majluf (1984) that discuss liquidity preferences under conditions of information asymmetry. Profitability and growth metrics are key indicators of operational effectiveness and market performance, widely examined in the literature on corporate growth and sustainability, including works by He and Tian (2018) and Yang (2022), which discuss the impact of financial strategies on growth.

Lastly, the labor cost ratio is particularly relevant for industries where human capital is a significant operational cost, with studies like Sytnik and Kravchenko (2021) exploring the relationship between labor costs and value added in knowledge-intensive firms.

Including dummy variables for firm size, country, industry, and years in the analysis (as detailed in Table 2) is aimed at controlling variability and isolating the effects of specific factors. Firm size dummies allow for assessment of financial strategies influenced by operational scale. Country dummies account for economic, regulatory, and cultural variations affecting financial metrics across regions. Industry dummies enable differentiation based on sector-specific dynamics such as capital intensity and regulatory environment. Finally, year dummies adjust for time-specific economic conditions and trends, providing a temporal context to the financial data, and enhancing the relevance of the analysis by accounting for external influences over the period from 2000 to 2023.

Methods

The methods employed in the empirical section of the study align with the primary objective, which is to investigate whether the capital structure and the factors influencing financing choices in knowledge-based firms differ from those in other sectors.

To test the first research hypothesis (H1), which posits that capital structure metrics and their firm-specific determinants differ significantly between knowledge-based firms and those from other industries, a one-way analysis of variance was conducted using industrial classification as the grouping factor, distinguishing knowledge-based firms (sectors M or J) from others.

The second hypothesis (H2), states that the impact of capital structure determinants differs between knowledge-based firms and other industries, was verified through panel data regression results conducted separately for the two groups: industries M and J versus other industries.

The model is defined by the formula (1):

$$D_{cist} = \beta_0 + \beta_1 FXA_{cist} + \beta_2 NTG_{cist} + \beta_3 DPR_{cist} + \beta_4 TAX_{cist} + \beta_5 LCR_{cist} + \beta_6 AVR_{cist} + \beta_7 ROA_{cist} + \beta_8 SGR_{cist} + \beta_9 STF_{cist} + \gamma_s SIZE + \alpha_c CT + \delta_i IND + \rho_t YEAR + \xi_{cst}, \quad (1)$$

where:

D_{cist} – one of the three debt measures (TTD, LTD, STD) in firm size s , country c , industry i in year t ,

$\beta, \gamma, \alpha, \delta, \rho$ – coefficients,

ξ – random factor,

other variables as specified in Table 3.

The panel data model assumes consistency in financial reporting standards across countries, which is critical given the multi-country scope. While the BACH database adheres to standardized financial metrics, variations in the implementation or interpretation of accounting standards could influence results. Additionally, the stationarity of variables was assumed for the econometric analysis. Although these assumptions align with established methodologies, potential deviations could impact the robustness of the findings. Future extensions of this research may involve robustness checks or adjustments for non-stationary variables.

It should be noted that in the case of estimations for sectors M and J, industry dummies were included only for these two industries. For other industries, the remaining industry dummies were included accordingly.

First, the model was estimated using pooled OLS for the two groups of industries separately with different dependent variables representing various debt maturities, excluding dummy variables. After removing insignificant variables, panel specification tests determined the most suitable model for explaining the dependent variable. The Wald F test assessed the suitability of the pooled model by examining the joint significance of group means. Rejection of the null hypothesis indicated that the fixed effects (FE) model was more appropriate. The Breusch-Pagan test compared the pooled model to the random-effects (RE) model, with the null hypothesis favoring the pooled model and the alternative suggesting the RE model. The Hausman test then compared the RE and FE models, where the null hypothesis indicated the RE model was consistent and efficient, while the alternative suggested the FE model was both consistent and efficient (Tsonas, 2019).

In most cases, the FE model was found to be appropriate. The model was then re-estimated with all dummy variables, and the Wald test verified the joint significance of each group of dummy variables (country, industry, size, and year). If the RE model was indicated as appropriate by the panel specification tests, interpretations were based on the RE model. The results of this analysis are detailed in the following section.

RESULTS AND DISCUSSION

The aim of the article was to identify and compare financing patterns in sectors comprising knowledge-based enterprises and traditional sectors, as well as the determinants of financial decisions made by both groups of entities in selected European Union countries from 2000 to 2023. The study attempted to explain the financial decisions of both groups of enterprises based on two opposing concepts, namely the trade-off theory (Modigliani & Miller, 1963; Fama & French, 1998; Rajan & Zingales, 1995; Opler & Titman, 1994) and the pecking order theory (Myers & Majluf, 1984; Myers, 1984). The influence of capital structure factors was analyzed in the context of the specific characteristics of knowledge-based enterprises, namely capital intensity and the high proportion of intangible assets (Coleman & Robb, 2012; Hogan & Hutson, 2005; Hyytinen & Pajarinen, 2005).

The empirical analysis aimed to investigate the capital structure and the factors influencing financing choices in knowledge-based firms compared to traditional industries. The analysis was conducted using a one-way analysis of variance (ANOVA) and panel data regression, with separate evaluations for knowledge-based sectors (M and J) and other industries.

Table 4 presents the one-way ANOVA results, where the grouping factor is the classification of sectors as knowledge-intensive or traditional. The debt metrics and firm-specific variables are analyzed to determine if there are significant differences between these two groups. The F-statistics and p-values are reported, with significant values indicating notable differences in capital structure metrics and determinants between knowledge-based and traditional firms. However, no significant cross-industry differences were observed in terms of total debt ratio (TTD), tax burden (TAX), and sales variability (SVR).

Table 4. One-way ANOVA results with the grouping factor as the classification of sector as knowledge-intensive or traditional

Statistic	Debt metrics					Firm-specific variables						
	TTD	LTD	STD	FXA	NTG	DPR	TAX	LCR	ASG	ROA	SVR	STF
F	3.3	222.1	115.9	507.5	347.0	13.2	1.5	6.8	21.5	29.8	0.0	11.9
p	0.068	0.000	0.000	0.000	0.000	0.000	0.223	0.009	0.000	0.000	0.900	0.001

Note: The values of F statistics were **bolded** for $p < 0.1$.

Table 5 shows the estimation results of panel regressions specifically for knowledge-intensive sectors (M and J), whereas Table 6 provides the estimation results of panel regressions for other sectors, excluding knowledge-intensive ones. The results reveal how different factors influence the capital structure of companies in knowledge-based sectors compared to traditional industries. The joint significance tests, Breusch-Pagan tests, and Hausman tests are included to ensure the robustness and validity of the models used.

Table 5. Estimation results of panel regressions for knowledge-intensive sectors (M and J)

Variable	TTD		LTD		STD ⁽¹⁾	
	Estimate	Std. error	Estimate	Std. error	Estimate	Std. error
const.	0.120***	0.120	0.167**	0.068	0.987***	0.060
FXA	0.078***	0.078	0.317***	0.078	-0.606***	0.074
NTG	0.175***	0.175	0.742***	0.155		
DPR			-0.591*	0.352		
TAX					0.386***	0.073
LCR	0.039***	0.039			-0.136***	0.038
AVR	0.017**	0.017				
ROA	0.216***	0.216	-0.764**	0.301		
SGR			0.000***	0.000	-0.000*	0.000
STF			-0.086**	0.042		
SIZE ⁽²⁾	No		ME***, LA***		LA*	
CT ⁽³⁾	BE***, HU***, DE***, ES***, FR***, HR***, IT***, PL***, PT***		BE***, HU***, DE**, ES***, IT***, PL***		BE***, HU***, DE***, ES***, FR***, HR***, IT***, LU***, PL***	
IND ⁽⁴⁾	M***		M**		No	
YEAR ⁽⁵⁾	2004***, 2005***, 2015*, 2016**		2004**, 2013*, 2014**		2011*, 2015**, 2016**, 2017*, 2018*, 2019*, 2020**, 2021**, 2022*	
No. obs.		401		403		403
R ²		0.696		0.678		n/a
AIC		-948.4		-1025.3		-1430.9
Panel specification tests						
Joint sign. of diff. group means	F(48, 333) = 8.8 (0.000)		F(49, 335) = 8.3 (0.000)		F(11, 195) = 7.6 (0.000)	
Breusch-Pagan	LM = 304.2 (0.000)		LM = 373.3 (0.000)		LM = 32.2 (0.000)	
Hausman test	H = 16.3 (0.038)		H = 14.1 (0.079)		H = 3.9 (0.410)	
Joint significance robust F test						
Size		n/a		8.7 (0.000)		1.6 (0.200)
Country		16.8 (0.000)		10.4 (0.000)		36.6 (0.000)
Industry		7.8 (0.007)		4.4 (0.040)		n/a
Year		4.3 (0.004)		3.5 (0.021)		104.6 (0.000)

Notes: ⁽¹⁾ – the model was estimated as random effects. Interpretation of parameters in relation to: ⁽²⁾ – small firms.

The estimation results provide evidence of the positive impact of intangible assets on the overall and long-term debt levels of knowledge-based firms. This relationship can be explained through the pecking order theory. As previously mentioned, significant information asymmetry, characteristic of knowledge-based firms, leads to an increased cost of equity capital, prompting these entities to choose cheaper debt capital (Frank & Goyal, 2009). The positive relationship between debt and intangible assets can also be linked to future growth opportunities associated with a competitive advantage based on knowledge (Sytnik & Kravchenko, 2021; Barney, 1991; Hitt et al., 2001). This indicates that the intangible assets held by knowledge-based firms enable them to generate significant income, positively influencing credit assessments and leading to increased debt levels. Conversely, Castro et al. (2015) found the opposite results, demonstrating a negative impact of intangible assets and growth opportunities on financial leverage, leading to reduced debt levels in European knowledge-based firms. Lim et al. (2020) highlight that identifiable intangible assets have a similarly positive impact on financial leverage as tangible assets, supporting firms' ability to obtain debt. Mann (2018) demonstrated that, in 2013, 38% of U.S. patenting firms used patent portfolios as collateral for secured debt. This indicates that certain types of intangible assets play a significant role in financing innovation.

Table 6. Estimation results of panel regressions for other sectors (A, B, C, D, E, F, G, H, I, L, N, P, Q, R, S)

Variable	TTD		LTD		STD ⁽¹⁾	
	Estimate	Std. error	Estimate	Std. error	Estimate	Std. error
const.	1.149***	0.057	-0.084**	0.035	1.070***	0.034
FXA	-0.279***	0.055	0.293***	0.047	-0.635***	0.028
NTG					0.064**	0.030
DPR			0.547***	0.146		
TAX						
LCR	-0.113***	0.013	0.021*	0.012	-0.153***	0.010
AVR					0.040*	0.022
ROA	-0.559***	0.101			-0.224***	0.052
SIZE ⁽²⁾	ME**		ME***, LA***		No	
CT ⁽³⁾	BE***, HU***, DE***, ES***, FR***, HR***, IT***, PL***, PT***		DE***, FR***, HR***, PL***, PT***		BE***, HU***, DE***, ES***, FR***, HR***, IT***, PL***, PT***	
IND ⁽⁴⁾	B*, D***, E***, F***, G**, H***, I*, L***, N***, P***, Q***, R***, S**		B***, D***, F***, G*, H***, I*, L***, N***, Q***		F*, N**, P**	
YEAR ⁽⁵⁾	2003–2007***, 2009**, 2010**		2003*, 2004**, 2008**, 2010–2022***		2007*, 2021**	
No. obs.	7202		2718		2718	
R2	0.558		0.592		0.813	
AIC	-5258.0		-5502.3		-7650.0	
Panel specification tests						
Joint significance	F(380, 2288) = 11.9 (0.000)		F(387, 2295) = 8.5 (0.000)		F(391, 2307) = 9.2 (0.000)	
Breusch-Pagan	LM = 4269.7 (0.000)		LM = 3027.2 (0.000)		LM = 3976.0 (0.000)	
Hausman test	H = 28.3 (0.002)		H = 76.1 (0.000)		H = 50.7 (0.000)	
Joint significance robust F test						
Size	5.6 (0.018)		8.7 (0.000)		n/a	
Country	42.3 (0.000)		40.0 (0.000)		26.6 (0.000)	
Industry	7.5 (0.000)		11.7 (0.000)		3.7 (0.011)	
Year	3.1 (0.003)		4.4 (0.000)		3.5 (0.031)	

Notes: ⁽¹⁾ – the model was estimated as random effects. Interpretation of parameters in relation to: ⁽²⁾ – small firms, ⁽³⁾ – Austria, ⁽⁴⁾ – agriculture sector (A), ⁽⁵⁾ – year 2000. Significance at the level of * – 10%, ** – 5%, *** – 1%.

In traditional firms, this positive relationship was observed only with short-term debt, indicating differences in the impact of intangible assets on capital structure between the two groups.

The asset structure of knowledge-based firms also promotes long-term debt, as explained by trade-off theory. Tangible assets serve as good collateral, reducing potential bankruptcy costs and encouraging higher financial leverage (Cevheroglu-Acar, 2018). Similar findings were reported by Yang (2022), who showed that American telecommunications firms with substantial commercial real estate had higher debt levels. Furthermore, these firms exhibited exceptionally high debt ratios (Habibniya et al., 2022). However, for overall and short-term debt, the asset structure's impact in knowledge-based firms was negative, as firms with significant tangible assets are less prone to issues arising from information asymmetry, lowering the cost of equity issuance and reducing their propensity to incur debt (Li & Islam, 2019). In both knowledge-based and traditional firms, these relationships were consistent.

Regarding the non-debt tax shield, an opposite impact on long-term debt was found in both groups. In knowledge-based firms, the impact was negative, consistent with both the pecking order and trade-off theories. According to the pecking order theory, firms accumulating funds through depreciation have less need for debt capital due to broader internal financing options (Kovacova et al., 2022). The trade-off theory posits that the non-debt tax shield can substitute the debt tax shield, leading to a negative relationship with debt levels (Poornima & Kumar, 2022). In traditional firms, a positive relationship was observed, explained by agency theory, which suggests firms increase debt to counteract the irrational use of free cash flow resulting from increased depreciation by managers (Jensen & Meckling, 1976).

In knowledge-based firms, the impact of tax burdens on short-term debt was positive, aligning with the trade-off theory (Fleckenstein, 2020), indicating limited use of the tax shield effect, primarily in working capital loans. In traditional firms, tax burdens were statistically insignificant.

In the first case, higher liquidity enables companies to undertake riskier projects and finance them through bank loans, as the lower risk of solvency issues makes lenders more willing to provide funding (Ramli et al., 2019). In the second case, it suggests that knowledge-based firms prioritize the use of their accumulated cash reserves and equivalents, thereby reducing their need for external borrowing (Garcia-Rodriguez, 2021). Such behavior is partially consistent with the pecking order and trade-off theory. In traditional firms, similar relationships were observed in the aforementioned debt areas. However, the impact of liquidity on long-term debt in this group was positive. The research findings are largely consistent with those of Castro et al. (2015), who demonstrated similar relationships between debt and financial liquidity in both European technology firms and other entities.

The impact of risk on overall debt in the group of knowledge-based firms was surprising, as it led to an increase in overall debt. This phenomenon can be attributed to the interventionist policies of the EU and member states regarding the activities of knowledge-based firms, which influence their financial decisions. Similar conclusions were reached by Jaworski and Czerwonka (2021), who found that the debt levels of the studied enterprises increased with rising financial risk in the sector. It can thus be assumed that the positive relationship between risk and debt is a specific feature of firms extensively using various support instruments and consequently subject to regulatory influences affecting their financial performance. However, this issue is difficult to interpret definitively and requires further in-depth research. Interestingly, in the group of traditional firms, risk positively affected short-term debt. This can be explained by the limited access to bank credit for high-risk firms. After exhausting internal financing, such entities are forced to rely on short-term obligations. This situation is characteristic, for example, of the construction sector (Badu et al., 2012).

Profitability was found to be a factor limiting debt in both knowledge-based firms and traditional enterprises. High-profitability firms typically exhibit low levels of financial leverage as they prefer internal financing. This relationship aligns with the pecking order theory. These conclusions are consistent with previous studies, such as those by Neville and Lucey (2022), Castro et al. (2015), and Che-Yahya et al. (2022). However, excessive dependence on internal finance can negatively affect firms' innovativeness. To address this issue, firms could increase their reliance on new equity finance and debt finance, particularly bank finance and trade credit finance (Ayalew & Zhang, 2024). This argument has been supported by other studies. Wellalage and Fernandez (2019) found a positive relationship between external finance and both product and process innovation. Similarly, Cui and Yang (2018) showed that equity financing constraints reduce Chinese firms' R&D investments, with this negative effect being particularly pronounced in industries heavily dependent on external financing.

Equity finance plays a crucial role for innovative firms, especially those with greater external financing needs, as it enables them to benefit from going public (Acharya & Xu, 2017). By overcoming financing frictions and improving access to capital, equity financing enhances innovation. Moreover, it allows investors to share in upside returns and facilitates the

funding of innovation investments by transferring idiosyncratic innovation risks to diversified investors through public equity markets (Bernstein, 2015).

Another factor significantly influencing the debt levels of knowledge-based enterprises is growth opportunities, which leads to an increase in long-term debt while simultaneously reducing short-term debt. The positive relationship between long-term debt and growth opportunities can be explained by the pecking order theory. According to this concept, the information asymmetry between managers and investors and the associated need to reduce information costs cause firms to prefer a specific order of financing sources for their investments. Therefore, commercial debt is considered a “more internal” source of financing than the issuance of bonds or equity (Garcia-Rodriguez, 2021). The positive relationship between long-term debt and growth opportunities can be attributed to the nature of knowledge-based enterprises. As mentioned earlier, knowledge-based firms, under the pressure of continuous development and significant growth potential, are compelled to seek additional financing sources. Moreover, these enterprises have considerable opportunities to obtain preferential loans and credits. Conversely, the negative relationship between growth opportunities and short-term debt aligns with the trade-off theory. The realization of growth opportunities is typically associated with high risk and increased expected financial distress costs, which limits debt (Lerner et al., 2022). Furthermore, knowledge-based firms, having access to preferential loans, reduce their short-term debt. Similar, mixed findings are consistent with previous analyses. The positive relationship between growth opportunities and financial leverage was demonstrated by Castro et al. (2015) in early-stage and declining-phase technology firms. According to these authors, during the maturity period, the impact of growth opportunities on financial leverage was negative.

The last capital structure factor analyzed was employment costs. In knowledge-based firms, these costs have a negative impact on financial leverage. High fixed costs associated with the salaries of highly skilled scientific and technical staff, as well as other R&D expenditures and the associated information asymmetry, are characteristic of these entities. These expenses represent a significant financial burden and consume a substantial portion of the generated income (Neville & Lucey, 2022). Due to banks' reluctance to finance risky ventures, these firms are forced to issue equity. These findings align with previous studies indicating that knowledge-based firms follow the modified pecking order theory. This theory suggests that companies relying on the external acquisition of technology (i.e., with high intangibility) are more successful in attracting external financing, whereas firms focusing on internally generated innovation through R&D activities tend to deter external capital (Kędzior et al., 2020; Tagliatalata & Mina, 2024; Minola et al., 2013; Serrasqueiro et al., 2016; Cosh et al., 2009).

However, recent changes in the financing environment for innovation-driven businesses have alleviated some of the challenges associated with low capital availability and high capital costs through FinTech credit (Thakor, 2020). Girardone et al. (2024), using a sample of 3,491 non-financial firms operating in 38 OECD countries between 2015 and 2021, explored the impact of FinTech credit on firms' cost of capital and capital structure. They observed a significant reduction of approximately 5.5% in the cost of debt and 3% in the cost of equity. Moreover, their findings highlight that FinTech credit has a particularly pronounced effect on firms operating in more innovative industries.

The comparative analysis of Tables 5 and 6 reveals both similarities and differences in the intensity and significance of size, industry, country, and year effects on the financing patterns and capital structures of knowledge-intensive sectors (M and J) versus traditional sectors (A, B, C, D, E, F, G, H, I, L, N, P, Q, R, S), reflecting the varying financial behaviors and constraints across these two broad groups of industries.

The size effect is significant in both knowledge-intensive and traditional sectors but manifests with varying intensity. In knowledge-intensive sectors, firm size significantly affects long-term debt (LTD), with both medium and large firms exhibiting significantly different debt levels compared to small firms. For short-term debt (STD), only large firms differ significantly from small firms, while total debt (TTD) shows no size effect. This pattern might reflect the resource constraints of small firms in accessing long-term financing, particularly in innovation-driven sectors where intangible assets dominate and limit collateral availability.

In traditional sectors, the size effect is slightly broader. Both medium and large firms show significant differences from small firms in total and long-term debt, likely highlighting their superior access to both types of financing. However, similarly to knowledge-intensive sectors, firm size does not significantly affect short-term debt, suggesting a shared reliance across all sizes on short-term liquidity management. These results show that while larger firms generally benefit from enhanced credit access across all sectors, the impact of size on long-term financing is more pronounced in traditional sectors due to their greater reliance on tangible assets.

The effect of firm size has been confirmed in many other studies, such as Che-Yahya et al. (2022), Castro et al. (2015), and Magri (2009). As Hadhri et al. (2016) highlighted, firm size determines access to innovative solutions, enables risk diversification, and creates the potential to obtain the benefits of economies of scale. The differences in innovativeness between smaller and larger firms may arise from the greater productivity, assets, and financial power typically possessed by larger businesses (Civelek et al., 2021). For these reasons, larger firms are generally able to invest more in innovative activities. Conversely, smaller firms are more specialized and exhibit better internal communication. This allows them to continuously introduce new products to the market, develop improved processes, change organizational structures, and enter new markets (Avermaete et al., 2003).

The country effect is robust in both groups, significantly influencing all types of debt (TTD, LTD, STD). Firms in countries like Belgium, Hungary, and Germany differ markedly from Austria, the reference country, in their debt structures. This consistency across Tables 5 and 6 highlights the importance of national financial systems and regulatory environments in shaping access to debt. However, the degree of variation is likely greater in traditional sectors, given the broader range of industries and their dependence on country-specific financial market characteristics. In contrast, the country effect in knowledge-intensive sectors may be tempered by the relatively homogenous financial needs of firms focused on R&D and innovation, which often benefit from EU-level support mechanisms and policies favoring knowledge-driven industries.

The variation in debt levels among European enterprises across different countries has been demonstrated in many other studies, such as Kędzior (2012). At this point, it is important to highlight the significant differences in local conditions across the analyzed countries. These conditions influence the level of innovation development in each country, as shown in Figure 1 and Figure 2.

Sectoral differences are significant in both groups but exhibit varied intensity. In knowledge-intensive sectors, the industry effect is confined to total and long-term debt, where the Professional, Scientific, and Technical Activities sector (M) differs significantly from the Information and Communication sector (J). These differences likely arise from slight variations in asset tangibility and business models, despite the sectors' shared focus on intangible, knowledge-based activities. Short-term debt shows no industry effect, reflecting the similar liquidity management strategies of these two closely related industries.

In traditional sectors, the industry effect is more persistent, significantly influencing total, long-term, and short-term debt. This reflects the diverse financial behaviors of traditional industries, where asset structures, market stability, and operational risks vary widely. For example, manufacturing sectors with high asset tangibility likely exhibit greater reliance on long-term debt, while seasonal industries like agriculture rely more on short-term financing. It is natural, however, to observe a slightly weaker industry effect in the group of knowledge-based sectors, which is composed of only two NACE sectors (M and J), compared to the group of other sectors, which is inherently larger and more diverse. Similar findings were obtained by Castro et al. (2015), who showed that the debt levels of European technology firms and entities from other sectors differ. The industry effect has also been confirmed in other studies, such as those by Kokoreva et al. (2023) and Che-Yahya et al. (2022).

Similar conclusions can be drawn regarding the year effect, indicating that the capital structure of the examined enterprises changed over the years. The year effect is evident in both groups, capturing temporal variations in debt levels relative to the reference year 2000. These changes could be attributed to fluctuations in the economic situation and related variations in the availability and cost of capital (Brown & Lee, 2019; Yang, 2022).

In knowledge-intensive sectors, significant year effects align with broader economic trends, such as post-crisis recovery or policy-driven shifts favoring innovation financing. Similarly, traditional sectors show pronounced year effects, particularly during periods of economic upheaval, highlighting the influence of macroeconomic conditions on debt usage.

A remarkable difference is the intensity of the year effect. In traditional sectors, the year effect is more widespread across debt types, reflecting their sensitivity to cyclical economic changes. In knowledge-intensive sectors, the year effect might be reduced by the targeted financial support and policy stability that often protects innovation-driven firms during economic downturns.

In summary, the study's results indicate that knowledge-based firms primarily shape their capital structure according to the pecking order theory. This is demonstrated by the negative relationships between debt and profitability, non-debt tax shield, financial liquidity, and, to some extent, asset structure, along with the positive relationship between growth opportunities and debt. These findings align with previous studies, such as those by Castro et al. (2015), Che-Yahya (2022), and Neville and Lucey (2022).

In contrast, the negative relationship between debt and employment costs suggests that the capital structure of knowledge-based firms can be partially explained by the modified pecking order theory (Tagliatalata & Mina, 2024; Minola et al., 2013; Serrasqueiro et al., 2016; Cosh et al., 2009). Traditional firms displayed similar patterns. The capital structure of these entities can best be explained by the pecking order theory, as evidenced by the negative relationships between debt and profitability, partially asset structure and liquidity, and the positive relationship between growth opportunities and debt. Additionally, the positive impact of the non-debt tax shield on debt aligns with agency theory. It is worth noting that in both groups, the positive impact of asset structure on long-term debt aligns with the trade-off theory. Moreover, in traditional firms, the positive relationship between long-term debt and financial liquidity provides further support for the trade-off theory.

These observations provide support for the first hypothesis, which suggests that the capital structure of knowledge-based firms is distinctive and differs from that of other firms. The second hypothesis was only partially confirmed, as the impact of some capital structure determinants on the debt of knowledge-based firms and traditional entities differs only to a certain extent.

CONCLUSION

The research findings support the first hypothesis, which assumes a differentiation between the financing patterns of the two groups of firms and their determinants. These differences are primarily reflected in the influence of intangible assets and employment costs on the debt of the analyzed companies. Knowledge-based firms align with the pecking order theory; however, to some extent, patterns characteristic of the modified pecking order theory also emerged within this group. This indicates that these firms primarily rely on internal sources of financing, turning to external financing, especially bank loans, only after exhausting internal funds. However, due to high capital requirements associated with substantial R&D investments and accompanying risks, these firms may face difficulties in obtaining bank loans. Consequently, they are often compelled to seek more expensive capital through equity issuance. This issue is partly mitigated by a well-developed support system for innovative activities, as such entities can access a wide range of financial instruments dedicated to them by the European Union and individual national governments, such as preferential loans.

Traditional firms, on the other hand, shaped their capital structure primarily in line with the pecking order theory, although some of their financing patterns also align with the agency and trade-off theories. These conclusions also support the first hypothesis.

The second hypothesis was only partially confirmed. The impact of capital structure factors varied only to a certain extent between the two groups of analyzed companies. These differences were especially evident in the relationships between debt and intangible assets, non-debt tax shields, and employment costs on the capital structure of the examined firms.

These findings directly address the research questions by demonstrating distinct patterns in financing behavior between knowledge-based and traditional firms and revealing the varied impact of specific determinants on their capital structures. The observed reliance on equity issuance in knowledge-based firms, for example, highlights the sector-specific financing challenges hypothesized at the study's outset.

The analysis reveals that their intensity and scope differ, while size, country, industry, and year effects are significant in both knowledge-intensive and traditional sectors. Traditional sectors exhibit broader variability across countries, industries, and years, reflecting their diverse asset bases and financing needs. In contrast, knowledge-intensive sectors demonstrate more focused variations, influenced by their reliance on intangible assets and alignment with policies supporting innovation. These findings highlight the unique financial behavior of knowledge-based industries and the broader structural heterogeneity of traditional sectors.

The results of this study have several practical and theoretical implications. First, by understanding the characteristics of variables describing the capital structure of knowledge-based firms and traditional businesses, analysts can use these findings to identify what constitutes a typical capital structure for each group of firms. Second, the identified similarities and differences in capital structure, along with the influence of various factors, enhance the current knowledge of financial decision-making in both knowledge-based firms and traditional businesses. Knowledge-based enterprises should avoid excessive reliance on internal finance, as it could negatively affect their innovativeness. Instead, they could enhance their dependence on new equity finance and debt finance, particularly bank loans and trade credit. Furthermore, given the potential for obtaining cheaper and more accessible capital, innovative firms should increasingly utilize alternative financing sources, especially FinTech solutions. Third, the results may prove useful for policymakers and investors

operating in the analyzed countries. Most importantly, due to the crucial role of innovation, especially its link to the socio-economic situation of a country, there is a need to intensify efforts to stimulate the development of knowledge-based enterprises. These efforts should focus on areas that hinder or limit the scale of innovation projects. Given the challenges associated with financing innovative activities, it is essential to create additional governmental support instruments and continue existing programs for both early-stage and established firms. Moreover, due to the greater risk of innovative activities compared to traditional ones, policymakers should implement initiatives that provide not only increased financial support but also educational assistance for knowledge-based enterprises. Collaboration with institutions such as patent and trademark registration offices is also essential to reduce barriers for these businesses when implementing innovative products and strategies.

Due to limitations associated with the data obtained from the BACH database, the analysis includes only selected European countries. Furthermore, the available data are highly aggregated, which has led to a significant generalization of the results. Another issue was the inability to include a variable that is crucial in the context of knowledge-based activities, namely, research and development expenditures. This factor was partially represented by employment costs; however, it is important to note that these costs are only a part of the overall research and development expenditures.

These limitations outline directions for potential further research. First, future studies should be expanded to include all European Union countries. Additionally, broadening the sample to encompass non-European contexts or emerging markets would enable an assessment of whether the findings are consistent across diverse economic environments.

Second, they should consider individual, disaggregated sectors and specifically selected groups of enterprises within these sectors. Collecting more detailed data at the firm level, rather than relying on aggregate industry-level data, would provide a more precise understanding of capital structure patterns. These firms should be chosen according to the definition of knowledge-based enterprises (Neville & Lucey, 2022), i.e., entities that have above-average research and development expenditures in their country and a higher proportion of scientific and technical staff compared to other firms.

Third, the unexpected positive impact of risk on total debt in the group of knowledge-based firms, likely related to the interventionist policies of the EU and member states regarding these entities, needs further, in-depth investigation as it is challenging to interpret definitively.

Finally, examining how macroeconomic fluctuations and policy reforms influence the capital structure choices of knowledge-intensive firms would contribute to a better understanding of the sector's specific characteristics.

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Biographical notes

Magdalena Gostkowska-Drzewicka (Ph.D.) is a lecturer in the Department of Corporate Finance at the University of Gdańsk, Faculty of Management. She is a graduate of the University of Gdańsk. She specializes in corporate finance, especially capital structure analysis. She is the author or co-author of over 40 publications and 3 books.

Julia Koralun-Bereźnicka, habilitated Ph.D., is an Assistant Professor in the Department of Corporate Finance at the University of Gdańsk, Faculty of Management. She specializes in corporate finance, particularly the impact of country, industry, and company size on corporate performance and capital structure. She has authored and co-authored numerous publications and has received several awards for her research.

Authorship contribution statement

Magdalena Gostkowska-Drzewicka: Conceptualization, Funding Acquisition, Investigation, Writing, Reviewing & Editing, Revisions. **Julia Koralun-Bereźnicka:** Data Curation, Formal Analysis, Methodology, Investigation, Writing, Reviewing & Editing, Revisions.

Conflicts of interest

The authors declare no conflict of interest.

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