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RESEARCH ARTICLE

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Business digitalisation as a driver of environmental and economic sustainability in micro, small, and medium-sized enterprises

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Abstract

In this study, we examine the direct relationship between business digitalisation and improvements in economic sustainability, as well as the potential mediating role of environmental sustainability. We also examine the potential role of company size as a moderating variable in these relationships. We gathered data from micro, small and medium-sized enterprises (MSMEs) in Finland. Contrary to initial expectations, our findings reveal that there is no direct and significant relationship between business digitalisation and the economic sustainability of enterprises; this relationship is only possible through the mediating role of environmental sustainability. We also found that, although high levels of environmental sustainability may result in improved economic outcomes, the strength of this relationship is much weaker for microenterprises than for their larger counterparts. Altogether, these results underscore the complex interplay between digitalisation and sustainability outcomes within the context of small businesses.

KEYWORDS
business digitalisation, digital technologies, environmental sustainability, microenterprises, MSMEs, sustainable business

1 | INTRODUCTION

Digitalisation has drastically revolutionised how individuals, societies, institutions, and companies operate and interact (Brenner & Hartl, 2021). In the business context, digitalisation involves incorporating digital products, services, and processes within companies (Hull et al., 2007; Proksch et al., 2021) to transform internal procedures and reach new markets (Gaglio et al., 2022). Consequently, business managers of companies from different sectors and sizes are increasingly interested in understanding the impact of the digital revolution on their organisations, particularly in transitioning from an industrial to a digital-centric economy (Björkdahl, 2020).

For micro, small, and medium-sized enterprises (MSMEs), digitalisation is a critical factor that may significantly support companies in their pursuit of enhanced economic profitability. For instance, the use of IT-related resources, such as computerised accounts or websites, has been proven beneficial for microenterprises in terms of improving internal operational efficiency, increasing operational capabilities, and enhancing external communications (Gherhes et al., 2016), which, in turn, are associated with superior economic benefits (Gherhes et al., 2016).

Since MSMEs are typically established with limited resources (Simba & Thai, 2019), the economic effect of business digitalisation is critical for achieving so-called economic sustainability. In this context,

economic sustainability refers to a business's capacity to operate in an economic balance that is not based on debts (Nasiri, Saunila, Rantala, et al., 2022). However, as Brenner and Hartl (2021) claimed, MSMEs must not focus solely on economic value creation; it is essential to also integrate environmental considerations into their strategic frameworks (Cantele & Zardini, 2018; Yang et al., 2024). Indeed, the global agenda concerning climate and environmental preservation places growing emphasis on the environmental sustainability of the smallest businesses (Karaeva et al., 2023). Thus, in addition to the challenge of digitalisation, MSMEs are transitioning towards environmental sustainability.

The emphasis on MSMEs is based on the argument that these businesses are a vital segment of the economies of developing, emerging, and even more developed countries (Simba & Thai, 2019). MSMEs comprise approximately 90% of all companies, generate between 60% and 70% of employment, and contribute to 50% of global Gross Domestic Product (GDP) (United Nations, 2023). In Europe, approximately 24.3 million MSMEs were active in Europe by 2022 (in the EU-27), accounting for 99.8% of all the enterprises (Di Bella et al., 2023).

Although MSMEs substantially contribute to global business activities, total productivity, and GDP at an aggregate level, they also significantly contribute to the production of solid waste and contamination of water and air resources, which in turn have an adverse effect on the natural environment (Rehman et al., 2022; Roxas, 2021). For instance, MSMEs account for a substantial portion of both environmental pollution and greenhouse gas (GHG) emissions, with 50% of GHG emissions and 30%–60% of energy use in the business sector (OECD, 2022).

Considering the cumulative environmental impact of MSMEs, these companies play a critical role in addressing the climate emergency and other planetary issues, which are becoming increasingly challenging to contain daily, such as the depletion of natural resources and loss of biodiversity (OECD, 2023b). The transition towards environmental sustainability is not possible if MSMEs are left behind. For that reason, small businesses are called to contribute to planetary challenges by adopting greener practices in their operations (e.g., minimising their environmental footprint) or by introducing ecological innovations (OECD, 2023b).

In the context of the twin green and digital transitions (Di Bella et al., 2023), it is unquestionable that the pursuit of both business digitalisation and environmental sustainability represents a crucial avenue for businesses to grow in the modern economy (Denicolai et al., 2021). However, despite the widely recognised role of MSMEs in digital and environmental transitions, along with the tremendous benefits of digitalisation in driving both environmental and economic sustainability in MSMEs, there has been little agreement in the scientific literature to date on whether and how business digitalisation can support the environmental and economic goals of these enterprises (Broccardo et al., 2023; Denicolai et al., 2021).

Based on the above, we analyse the relationship between these constructs in the context of MSMEs in Finland. This geographical setting is particularly interesting because Finland can be considered an MSME country, making it an ideal context for this study. For instance, in 2021, MSMEs accounted for 99.9% of all Finnish companies (Statistics Finland, 2023). The majority of companies employing fewer than 10 persons represent 96.6% of all active businesses in Finland, while small and medium-sized enterprises (SMEs) account for 2.8% and 0.5%, respectively. Conversely, large companies account for 0.1% of the total active companies (Statistics Finland, 2023).

Although Nordic countries are well positioned to capitalise on the benefits of digitalisation due to their robust access to digital infrastructure, they exhibit some differences in the stages of digitalisation implementation (Berlina & Randall, 2019). We considered Finland an interesting context of study, particularly because it leads the digital transformation arena in Europe. According to the Digital Economy and Society Index (DESI) (European Commission, 2022) Finland ranks first among EU countries on the integration of digital technology, with scores significantly higher than the EU average. Digital technologies are at the heart of Finnish business functions, with 82% of Finnish SMEs having at least a basic level of digital intensity (European Commission, 2022), significantly higher than the EU average of 55%.

Finnish companies also surpass the EU average in both cloud solution adoption and integration of AI technology in business operations, with 66% using cloud solutions and 16% incorporating AI. Additionally, 77% of the companies in Finland employ Information and Communications Technology (ICT) at medium- to high-intensity levels for environmental action (European Commission, 2022). Regarding Finnish microenterprises, in 2020, 96% of the businesses employing at least 10 individuals had websites, with 75% utilising cloud services (Statista, 2021).

Additionally, Finland is one of the countries with the most significant progress in terms of implementing strategies for a circular economy and environmental protection, and is committed to becoming carbon neutral by 2035. Finland has also developed the world's first national roadmap to a circular economy and has been at the forefront of adopting EU environmental policies (OECD, 2021a). Therefore, many companies have made enormous sustainability commitments that allow them to gain a first-mover advantage (OECD, 2021a).

Digitalisation and a dual focus on environmental and economic sustainability are relevant factors in the business arena. However, the academic literature has seldom discussed the potential mediating role of environmental sustainability in the relationship between business digitalisation and economic sustainability, particularly within the context of MSMEs. In line with the aforementioned, we pose the following guiding research question: What is the relationship between business digitalisation, environmental sustainability, and economic sustainability, and how does this relationship differ for microenterprises compared to their larger counterparts?

The relevance of our study lies in the fact that the existing evidence regarding the proposed relationships remains inconclusive. For instance, some studies assert that digitalisation directly improves a company's economic outcomes (Bellakhal & Mouelhi, 2023; Martínez-Caro et al., 2020; Truant et al., 2021), while others find no direct relationship between the use of digital technology and a firm's financial performance (Tsou & Chen, 2021). Furthermore, research indicates

that digitalisation can act as a catalyst for environmental sustainability (Haq & Huo, 2023; Issah et al., 2024).

Within the broader Nordic context, particularly in Finland, only a limited number of studies have explored the relationship between digitalisation and enterprises' environmental and economic sustainability. For instance, Saunila et al. (2019) examined the relationship between smart technologies and corporate sustainability in 280 Finnish SMEs with 20–250 employees. The primary objective of this study was to examine the relationship between the adoption of smart technologies and various dimensions of sustainability within these companies. However, no direct association between smart technologies and environmental sustainability was found.

Similarly, Sipola et al. (2023) qualitatively examined the role of artificial intelligence in advancing sustainability in large Finnish enterprises. The authors argued that the pursuit of environmental sustainability has become a pivotal objective among Finnish enterprises, increasingly influencing their competitive advantages. Furthermore, they highlighted the significant potential of AI applications in enhancing environmental sustainability within firms.

In light of existing research, this study makes two main contributions. First, it examines whether and how business digitalisation is directly associated with improvements in companies' environmental and economic sustainability, and whether environmental sustainability plays a mediating role in this relationship. Second, this study considers the potential moderating role of company size in determining whether microenterprises exhibit different patterns in the hypothesised relationships.

The remainder of this paper is organised as follows. Section 2 examines the related literature and research hypotheses. Section 3 outlines the methodological aspects of this study. Section 4 presents the main results of the research, while Section 5 discusses the main implications of the results, contextualising them within the framework of the proposed hypotheses and existing research. Section 6 concludes the paper with a reflection on the study's overall contributions, future lines of enquiry, and potential limitations.

2 | THEORETICAL BACKGROUND

Although digitalisation is a phenomenon of enormous relevance to ensure the resilience and growth of companies of all sizes, its adoption is imperative for MSMEs. Business digitalisation has the potential to provide multiple benefits to MSMEs, which often operate in a context of limited resources and business knowledge (Cunningham et al., 2023). MSMEs are known for their adaptability. In that sense, digitalisation provides MSMEs with the basis for seeking disruptive innovation, improving their products, services, and business processes, and increasing business performance, including economic benefits (Cunningham et al., 2023).

According to the resource-based view (RBV), companies differ in terms of their resources and competencies (Barney, 1991; Del Giudice et al., 2017). Based on this theoretical framework, integrating new digital technologies is regarded as a means of selecting resources and enhancing capabilities to create a sustained competitive advantage (Nafizah et al., 2023). We relied on the postulates of this theory to explain the complex relationships among business digitalisation, environmental sustainability, and economic sustainability.

Given that the RBV focuses on how a firm's unique resources and capabilities can lead to competitive advantage and superior business performance (Barney, 1991), we found this theory appropriate to guide the assumption that companies can effectively develop and use their digital capabilities in their environmental and economic efforts. However, as outlined by Hassan et al. (2023), it is important to note that there is an extensive debate in management research about whether to consider digital capabilities as a unique and inimitable resource or as a more generic resource.

Although digital technologies are widely available to businesses across all sectors, making them easily adaptable by competitors, companies with unique experiences can provide their customers with digitalised products, services, and processes that are difficult to imitate, thereby achieving a sustained competitive advantage. Based on this, we consider the RBV helpful in explaining how a company's internal resources (e.g., digital capabilities) and characteristics (e.g., size) interact with its environmental and economic outcomes.

2.1 | Business digitalisation and economic sustainability

Business digitalisation entails the integration of digital products, services, and processes within a company (Hull et al., 2007; Proksch et al., 2021). Digital products and services may include a wide array of digital elements, media utilisation or applications, and essential digital components that deliver their primary functionality (Proksch et al., 2021). Conversely, digital processes encompass all actions that generate value through digital technologies, offering frameworks to develop architectures aimed at providing complementary solutions (Proksch et al., 2021).

Business digitalisation is beneficial for developing a digital mindset, simplifying the process for companies to understand and address their consumers' needs, thereby avoiding resource wastage, financial losses, and conflicts with clients (Wang et al., 2023). It also enables owners of small enterprises to enhance their business processes, leading to innovative offerings, better adaptation to changing consumer trends, and the introduction of new products and services (Hassan et al., 2023). To determine whether digitalisation is financially rewarding, some studies have found that companies with a high level of digitalisation are more likely to adopt advanced digital technologies to add value to their portfolio of products and services and create digital value for their customers, which in turn can lead to superior economic performance (Wang et al., 2023).

However, evidence concerning the link between digitalisation and business economic outcomes remains unclear. In practice, this relationship proves to be much more complex. For instance, some studies claim that increased digitalisation is not necessarily associated with improved economic benefits. In fact, at times, digitalisation can even

introduce new economic challenges for companies (Yu et al., 2023). Other authors also indicate that business digitalisation can negatively impact a company's overall outcomes (Wang et al., 2023). For instance, Yu et al. (2023) argued that digitalisation can lead to a paradoxical scenario in which businesses must address rapid digital transformation, potentially resulting in unintentional competition that could reduce business revenue or even result in negative returns.

Although there is still not enough consensus regarding the economic benefits of business digitalisation, we align with the body of literature claiming that digital technologies can foster operational efficiency, reduce production costs, and increase business profits through improved information processing (Li et al., 2020). This is mainly because, from the theoretical perspective adopted in this study, business digitalisation is a key resource that can contribute to long-term financial stability and growth. To maintain consistency with this statement, we posit the following hypothesis:

H1. Business digitalisation is positively related to firms' economic sustainability.

2.2 | Business digitalisation and environmental sustainability

The transformation and exploitation of the Earth's resources into wealth through intensive industrial activities have adversely affected natural ecosystems and societies (Caglar et al., 2024; Linnenluecke & Griffiths, 2013). Thus, while the economic activities of many companies are the primary source of emissions, pollution, and biodiversity loss, these same companies are suffering the devastating consequences of climate change and other planetary concerns (Saget et al., 2022).

In the context of the growing urgency to safeguard the Earth from irreversible ecological harm, companies are expected to increase their concerns about the natural environment and reduce the environmental impacts of their operations (Lucato et al., 2017). According to Lee and Roh (2023), digitalisation is a critical driver in enhancing business efficiency and reducing carbon emissions because it allows companies to advance in terms of resource utilisation and allocation, leading to environmental improvements.

Although digitalisation is expected to assist companies in their strategic efforts to enhance their environmental sustainability, not all studies have demonstrated the beneficial impact of business digitalisation initiatives on environmental sustainability (Bendig et al., 2023). For instance, Li et al. (2020) argued that digital technologies can increase the competitive dynamics of the business environment, potentially influencing the achievement of companies' environmental strategies.

However, a larger body of literature argues that, in addition to optimising resource allocation, digitalisation allows companies to enhance the visibility and communication of their environmental practices (Yang et al., 2023) to a range of stakeholders. This can be attributed to companies' concerns about preserving their reputation, particularly among clients, while minimising their environmental impact (Yang et al., 2024). From a knowledge management perspective, digitalisation also supports companies in reducing the costs associated with external knowledge search (Yang et al., 2023), as it enables companies to access critical and strategic information through both sharing and resource agglomeration effects (Wu et al., 2023).

Access to external knowledge would further contribute to better absorption of environmental sustainability-related knowledge in the form of specialised training, valuable case studies, or industry-specific sustainability reports. Additionally, when small businesses acquire new knowledge and competencies, they are more likely to establish relationships with other organisations and generate new products and processes aligned with improvements in environmental performance (Ardito et al., 2021). Other authors also suggest that digitalisation is positively associated with a greater probability of engaging in environmental innovation (Guo et al., 2023).

Thereby, we hypothesise that:

H2. Business digitalisation is positively related to firms' environmental sustainability.

2.3 | Environmental sustainability and economic sustainability

Companies' environmental sustainability is expected to improve due to the strategic opportunities associated with the environmental responsibility demanded by different stakeholders (de Villiers et al., 2011). Raza and Woxenius (2023) asserted that an increasing body of research suggests a positive association between sustainable business practices and economic sustainability. The rationale behind this positive relationship is that companies that prioritise environmental sustainability and incorporate environmentally responsible practices are more likely to experience improvements in their economic outcomes (Raza & Woxenius, 2023).

For example, de Villiers et al. (2011) argued that strong environmental sustainability is generally associated with reduced operating costs and greater economic gains due to the exploitation of market opportunities derived from the demand for environmentally sustainable goods and services (de Villiers et al., 2011). According to Raza and Woxenius (2023), the presumed positive relationship between the two constructs can be mainly attributed to the reputational benefits associated with being an environmentally responsible company, the cost savings and operational efficiencies derived from environmentally responsible practices, and the evolving regulations and societal expectations that incentivise companies to constantly improve their environmental practices.

The relationship between environmental and economic sustainability has been examined at the corporate level from various disciplines and perspectives. Although the findings are mixed, an extensive body of literature provides significant evidence supporting a positive association (Busch et al., 2023). However, most studies analysing the relationship between environmental sustainability and economic

performance have predominantly focused on large companies, exposing the need for more studies to determine whether the advantages of adopting environmentally sustainable practices are limited to large corporations (Cantele & Zardini, 2018).

Traditionally, the literature on the economic benefits of environmental sustainability has been dominated by analyses of the causal relationship between environmental and financial performance, assuming that it leads to a win-win situation. From the RBV, the logic of this relationship is that environmental practices are valuable resources capable of increasing economic results through cost reduction, product and process improvements, and favourable positioning of the business image, leading to higher sales and profitability (Rintala et al., 2022). Accordingly, it is expected that firms can improve their economic position based on the premise that environmental practices, such as reducing pollution and energy consumption and using fewer resources, will increase firm profitability (Amankwah-Amoah & Syllias, 2020).

Accordingly, we hypothesise that:

> **H3.** Environmental sustainability is positively related to firms' economic sustainability.

2.4 | The mediating role of environmental sustainability between business digitalisation and economic sustainability

The question regarding to what extent an increase in business digitalisation can lead to better environmental and economic sustainability is attracting the attention of both scholars and managers. As explained by Wang et al. (2023), this is a critical concern for companies, as most of them are still in the exploratory stage of digital adoption, and achieving a mutually beneficial balance between economic and environmental sustainability in the context of digitalisation can be challenging.

Previous studies have suggested that firms can enhance their environmental and economic sustainability through investments in digital technologies (Wang et al., 2023). However, the relationship between digitalisation, environmental sustainability, and economic output was not necessarily positive in all cases. For instance, even if companies can improve their environmental practices with the support of digital tools, the influence of environmental improvements on economic sustainability can still vary (Li et al., 2023).

Companies may also take advantage of the economic advantages and market opportunities derived from improving the environmental performance of their products, services, and processes through digitalisation. Thus, digitalisation is expected to affect different business sustainability targets, directly enhancing economic sustainability or through environmental practices, ultimately resulting in positive economic performance (Broccardo et al., 2023).

Although it has been proven that digitalisation can significantly impact economic outputs, the question remains whether environmentally sustainable practices driven by digitalisation can lead to better economic sustainability for firms (Broccardo et al., 2023). In this context, environmental sustainability can play a mediating role by allowing companies to realise the full potential of business digitalisation for their economic sustainability. Based on existing research, we propose the following hypothesis to test the presence of this association:

> **H4.** Environmental sustainability positively mediates the relationship between business digitalisation and economic sustainability.

2.5 | The moderating role of firm size

Differences in organisational structures and strategies between large companies and MSMEs, there is heterogeneity between microenterprises and SMEs (Rastrollo-Horrillo, 2021). Gherhes et al. (2016) and Rastrollo-Horrillo (2021) highlighted two distinctive characteristics of SMEs. (1) Smallness: these enterprises face more resource constraints, such as a lack of capital asset technologies, and face multiple challenges in gaining access to financial and human resources. (2) Owner centrism: Microenterprises are companies with few permanent employees; therefore, strategic decisions are the responsibility of the owner or manager, who directly influences the management style and performance of the business.

Due to their small size, microenterprises are expected to demonstrate distinctive attitudes and strategic reactions to digitalisation (Jones et al., 2014) compared to SMEs. In regards to digitalisation, the well-known constraints associated with small businesses (e.g., financial, skilled personnel, and resistance to change) may be more pronounced in microenterprises (Radicic & Petković, 2023), implying that many businesses are struggling to adapt to the digital imperative and lag behind in the digital transition (OECD, 2023b). Business digitalisation also can have heterogenous or modest effects in smaller firms (Radicic & Petković, 2023).

Furthermore, scientific evidence suggests that company size is a critical factor influencing perceptions of the economic rationale for sustainable practices (Revell & Blackburn, 2007; Roxas, 2021), with microenterprises often demonstrating the weakest awareness of commercial arguments in favour of environmental sustainability (Jibril et al., 2024; OECD, 2023b).

In the Italian context, Broccardo et al. (2023) found that company size strongly influences digital implementation and sustainability, demonstrating that larger companies tend to exhibit higher levels of digitalisation and sustainability performance, which in turn can be associated with better profitability. In the case of microenterprises, managing digital, environmental, and economic aspects can be complex and challenging. Since microenterprises often lack the necessary financial strength, it is challenging to fully embrace digitalisation, which typically involves modifying products, processes, and organisational structures (Pronti et al., 2024).

Additionally, the high dependence and significant influence of the owner or manager on the strategic decisions of microenterprises, such as those related to translating pro-environmental ideals into practical

actions, can improve the environmental sustainability of the firm if the manager has a positive attitude towards green business. However, this is not always the case (Pronti et al., 2024). We concur with Ardito et al. (2021), who claimed that context matters, and that small firms differ in their approaches to strategy execution and, notably, in their capacity to allocate resources towards digitalisation and environmental and economic sustainability. Accordingly, we propose that:

H5a. Firm size moderates the relationship between business digitalisation and economic sustainability.

H5b. Firm size moderates the relationship between business digitalisation and environmental sustainability.

H5c. Firm size moderates the relationship between environmental and economic sustainability (see Figure 1).

3 | METHODS

3.1 | Sample and data collection

This study's empirical context is based on a sample of 95 micro, small, and medium-sized enterprises (MSMEs) in Finland's Päijät-Häme region. Located in Southern Finland, the Päijät-Häme region has a population of approximately 206,000 (The Regional Council of Päijät-Häme, 2024). The region has forests and water as its primary resources. Significant economic sectors include forestry, furniture manufacturing, and the metal, plastic, and textile industries (Vanhamäki et al., 2020). Notably, Päijät-Häme was among the first regions in Finland to implement a circular economy roadmap (Vanhamäki et al., 2020), with sustainable business from the bio-circular economy, new consumption models, innovative circular solutions, and sustainable transport and energy solutions as the main guiding themes.

In this study, the unit of analysis was a company, while the unit of observation was the manager or owner of a company. We chose managers and owners as respondents to assess our constructs because they are expected to have adequate knowledge about their companies' operations, their orientation towards digitalisation, and the environmental and economic sustainability achieved by the companies they lead (Saunila et al., 2019).

The data for this study were collected via a web-based survey, encompassing both firm- and study-theme-related constructs. Respondents were identified from the database of a local supporting business organisation, selected because it is the most comprehensive list available (to the best of the researcher's knowledge). It covered a large number of small, active companies that were difficult to find because most of the databases covered larger companies. The initial sample comprised approximately 3000 firms with a maximum of 250 employees, adhering to the threshold identified by the Federation of Finnish Enterprises in the Päijät-Häme region. This sample yielded

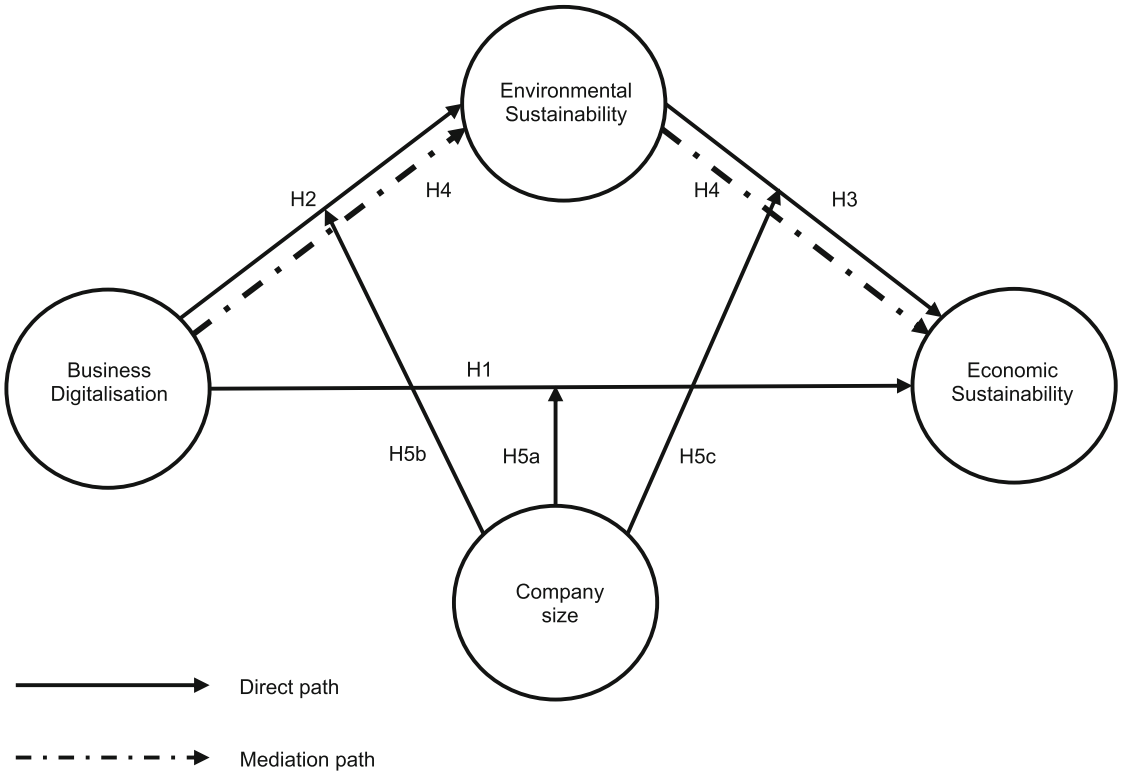

FIGURE 1 Proposed research model. *Source:* Authors' own elaboration.

98 valid responses. Following data screening, three questionnaires were excluded from the analysis to avoid bias in the sample composition, given that the respondents claimed to lead a company with more than 249 employees.

Table 1 presents the companies' main characteristics. It is important to note that most of them were microenterprises (62%). These microenterprises had an average of three employees, with 42.4% having only one employee, in addition to the manager/owner. Additionally, 39% of all the companies were well-established organisations (more than 20 years old), while the second largest group comprised companies with a maximum of 5 years since being founded (32%).

3.2 | Measures

3.2.1 | Dependent variable

Economic sustainability was measured based on two items (Table 2) scored on a 4-point Likert scale ranging from 1 (weak) to 4 (excellent). In this study, we considered economic sustainability as a firm's outcome, indicating profitability and economic sustainability improvements. Profitability, a key organisational performance criterion, has been used previously in studies addressing the effects of Industry 4.0, on firms' economic gains (Calış Duman & Akdemir, 2021), as well as in the digital-sustainability-economic performance nexus in Italian companies (Broccardo et al., 2023). On the other hand, economic sustainability is an indicator used to determine whether companies operate in an economic balance that is not based on debts (Nasiri, Saunila, Rantala, et al., 2022).

TABLE 1 Sample description.

Characteristics	Frequency (*n*)	Percentage (%)
Industry type		
Production	26	27
Services	69	73
Age (years)		
5 or fewer	30	32
6–10	12	13
11–15	11	12
16–20	5	5
More than 20	37	39
Customer base		
B2C	26	27
B2B	69	73
Number of employees		
0–9 (Micro)	59	62
10–49 (Small)	23	24
50–249 (Medium)	13	14
Total	95	100

Source: Authors' own elaboration.

3.2.2 | Independent variable

Business digitalisation is measured with five items (Table 2) and scored on a scale ranging from 1 (strongly disagree) to 5 (strongly agree). The items were adapted from previous studies such as Lee and Roh (2023) and Proksch et al. (2021). In this study, we defined business digitalisation as the growing integration of digital products and services and digitalised processes (Hull et al., 2007; Proksch et al., 2021). In the context of this study, high digitalisation scores suggest that companies offer digital-related products or services and use digital processes to support their offerings (Proksch et al., 2021).

3.2.3 | Mediating variable

To measure companies' overall environmental sustainability, we used a single item (Table 2) in which the participants were asked to evaluate their companies' environmental sustainability (minimising environmental impact) using a scale ranging from 1 (weak) to 4 (excellent). In this study, environmental sustainability was defined as the level at which an organisation's strategy contributes to minimising its impact on the natural environment (Nguyen & Adomako, 2022).

Although the use of single-item measures may introduce some limitations compared to multiple-item measures, they can be adopted when the empirical study refers to a particular object or phenomenon, and if the measure and object of the study are made clear to the respondents (Saunila et al., 2019). For instance, Manika et al. (2015) conducted a study in seven different organisations in the United Kingdom where they used a single-item measure to evaluate the perceived environmental behaviour of the organisations. They asked a sample of 1204 employees to indicate how environmentally friendly the organisation they were working for was in comparison to what it could be.

A similar single-item measure was used to evaluate the sustainability strategy (Saunila et al., 2019; Ukko et al., 2019) and environmental sustainability (Nasiri, Saunila, Rantala, et al., 2022) of SMEs in Finland. Additionally, Prömpeler et al. (2023) explored the director's and CEO's environmental sustainability focus in the Dutch housing sector using survey data and employing a single-item measure. According to these authors, single-item measures may have the same predictive validity as multiple-item measures, as they avoid irritation among respondents by requiring them to respond to numerous similar questions (Prömpeler et al., 2023).

We used varying scale ranges to measure the constructs. This strategy aims to minimise common method bias (CMB), as recommended by Podsakoff et al. (2012). They suggested that applying similar question formats could lead respondents to use the same thought processes for different questions, potentially biasing their results. By varying the response formats, we reduced the likelihood that answers to one question would influence the responses to others. Memon et al. (2023) also suggested that varying both the scale type (4- and 5-point Likert scales) and the anchors (from performance quality to agreement intensity) are procedural strategies that can preserve the

TABLE 2 Constructs and items.

Construct	ID	Items	Mean	SD	Min	Max
Business digitalisation	DIG1	Our company's equipment and functions create good conditions for utilising digitality.	3.61	1.28	1	5
	DIG2	The processes of our company utilise a lot of digitality.	2.43	1.24	1	5
	DIG3	We utilise digitalisation in a key part of our products.	3.26	1.38	1	5
	DIG4	We use digitalisation as a key part of our services.	3.47	1.23	1	5
	DIG5	Our service portfolio includes a lot of digital services.	2.52	1.39	1	5
Economic sustainability (in relation to other similar companies in the industry)	ECON1	The profitability of our company is…	2.80	0.66	1	4
	ECON2	The economic sustainability of our company (operating in an economic balance that is not based on debts) is…	2.94	0.80	1	4
Environmental sustainability (in relation to other similar companies in the industry)	ENV	The environmental sustainability of our company (minimising environmental impact) is…	3.15	0.618	1	4

Source: Authors' own elaboration.

content validity of the questionnaire while minimising the risk of respondents using similar cognitive processes across different types of questions.

3.2.4 | Moderating variable

To account for the effect of firm size on the hypothesised relationships, we created a dummy variable based on the number of full-time employees in the companies. The definitions and classifications used in the context of MSMEs vary by country. In this study, we adhered to the proposal of both the OECD and European Commission, which classifies companies according to the number of employees as follows: microenterprises (fewer than 10 employees), small enterprises (10–49 employees), and medium-sized enterprises (50–249 employees) (Di Bella et al., 2023; OECD, 2023a).

Considering the above definition, our dummy variable takes the value of 1 if the business is a microenterprise (less than 10 employees), and zero otherwise (small or medium-sized). We made this decision considering that most of the companies included in this study were microenterprises, and due to their particular nature, it is not desirable to generalise the findings on SMEs to the smallest companies (Gherhes et al., 2016). Additionally, a dummy variable facilitates the analysis of moderating effects and subsequent interpretations. Furthermore, as suggested by Hair et al. (2022), moderation analyses provide a valuable approach for gaining a deeper understanding of data heterogeneity.

3.2.5 | Control variables

We included several control variables to mitigate potential biases arising from omitted variables. We controlled for the age of the firm, as younger firms are more likely to be positively influenced by digitalisation in their environmental management practices (Issah et al., 2024). We also included the customer base (B2B/B2C) as it has been used as a relevant control variable in sustainable business research (Nasiri, Saunila, Rantala, et al., 2022), considering its potential impact on digitalisation strategies and sustainability practices. Finally, we controlled for the firm's sector, distinguishing between production and services, as sector has been found to influence profitability (Boakye et al., 2020), and unlike production firms, service firms experience close interactions between products and processes (Prajogo, 2006).

3.3 | Data analysis technique

In quantitative research, the link between theoretical concepts and measurable entities that represent them is referred to as an epistemic relationship. While one out of the three variables included in our research model is directly measured by one indicator, two key constructs in our study (i.e., business digitalisation and economic sustainability) are composite variables measured by several indicators. Therefore, we used structural equation modelling with Partial Least Squares (PLS-SEM) to test the hypotheses, as PLS-SEM serves as a technique for estimating path models with composites and their relationships.

PLS-SEM is a variance-based SEM approach where the indicator variance is used to explain the model relationships and predict the dependent variable (Hair et al., 2022). Based on the guidelines of Hair et al. (2022), we decided to use PLS-SEM, considering the following factors:

a. The theoretical scope of the study: PLS-SEM is highly recommended when the research objective is oriented towards exploration rather than theory confirmation.

b. Data characteristics: PLS-SEM works efficiently with small sample sizes and different measurement scales. It is a non-parametric approach that is robust when handling non-normal data. We ensured that we fulfilled the minimum sample size requirements based on the guidelines of Nitzl (2016) to ensure that the results of our statistical procedure had adequate statistical relevance.
c. Measurement characteristics of the model: PLS-SEM allows researchers to use constructs that are measured using single- and multi-item measures from the same model.
d. Complexity of the model: PLS-SEM is a suitable choice for theoretical models that simultaneously examine mediating and moderating effects.
e. Estimation of the model: In terms of estimation, PLS-SEM offers higher levels of statistical power than other methods, such as Covariance-based Structural Equation Modelling (CB-SEM) (Hair et al., 2022).

3.4 | Non-response bias and common method bias

Considering the need to send reminders to participants during the application of the web-based questionnaire, non-response bias may represent a risk (Armstrong & Overton, 1977). We assessed the potential for non-response bias by comparing the answers of early and late respondents to all study items. The responses of 20 early participants were compared with those of 20 late participants. Based on the analysis of the variance test (at the 5% significance level), we concluded that no statistically significant differences existed between early and late respondents.

Furthermore, considering that the answers to the constructs used in this study were obtained from individuals who participated in a cross-sectional survey, it was imperative to comprehensively evaluate the possible impact of CMB. CMB typically occurs when dependent and independent variables are measured through the same survey, from the same source of information, and using a similar response method (Kock et al., 2021). To mitigate CMB in this study and following the recommendations provided by Podsakoff et al. (2003), we applied procedural and statistical techniques.

Regarding procedural controls, we adopted the following measures. We provided clear instructions to the participants regarding the context of the study and how the questions were to be answered. We also guaranteed the anonymity of the survey and the confidentiality of their responses. Third, we used clear and simple language in the questionnaire to avoid complex and ambiguous wording. Overall, we were meticulous about the length of the questionnaire, considering that short questionnaires, such as ours, can reduce fatigue among respondents and decrease the cognitive efforts to answer the questions (Kock et al., 2021).

With respect to the recommended statistical procedures, we performed Harman's single-factor test using SPSS 26.0, which revealed the existence of five primary factors that collectively explained 86.47% of the total variance. The largest factor accounted for 38.94% of this variability; however, it did not capture the majority of the covariation observed among the measures. Following Kock's (2015) recommendations, we performed a full collinearity test using SmartPLS 4.0.9.3. The findings from the analysis indicated that all variance inflation factors (VIF) remained below the prescribed threshold of 5, as suggested by Hair et al. (2019). Consequently, it can be deduced that CMB was not a noteworthy concern in this study.

4 | RESULTS

PLS path models rely on two sets of linear equations: the measurement model, which indicates the relationships between a construct and the observed indicators or manifest variables used to measure that construct; and the structural model, which specifies how the constructs are related to each other (Henseler et al., 2016). In the following paragraphs, we describe the evaluation of the structural and measurement models used in this study.

4.1 | Evaluation of the measurement model

The proposed research model follows a reflective structure in all constructs to measure unobservable variables, meaning that the constructs cause covariation in the indicators (Hair et al., 2022). Indicator reliability, internal consistency reliability, convergent validity, and discriminant validity are the criteria used to evaluate the reflective measurement models (Hair et al., 2022).

First, we examined the size of the outer loadings of the indicators (Table 3). Outer loadings indicate how much the associated indicators of a construct have in common (Hair et al., 2022). According to Hair et al. (2022), standardised outer loadings should be 0.708 or higher. All our indicators met this criterion.

Second, we evaluated the internal consistency reliability of the constructs (Table 3) by examining the Cronbach's alpha (Cα), Dijkstra–Henseler's rho (ρ_A) value, and composite reliability (CR) (Garcia-Pereyra et al., 2023). For our constructs, all internal consistency reliability criteria exceeded the values recommended by Hair et al. (2022), with values higher than 0.7 (Table 4).

To examine convergent validity, which measures the extent to which a given measure correlates positively with other measures within the same construct (Hair et al., 2022), we used the average variance extracted (AVE). The AVE values for the constructs exceeded the recommended threshold of 0.5 (Table 3), showing that the indicators in each construct had a high degree of communality.

Finally, we examined the discriminant validity of the proposed model. This is an indicator of the degree to which a construct is statistically and empirically different from the other constructs (Benitez et al., 2020). We used the heterotrait–monotrait (HTMT) ratio of the correlations to assess discriminant validity. Although the ideal threshold for HTMT values is debatable, the most conservative threshold considered in the literature is 0.85 (Hair et al., 2022). Our model did not have discriminant validity concerns because all values were considerably lower than 0.85 (Table 4).

TABLE 3 Indicator reliability, internal consistency reliability, and convergent validity.

Constructs	Indicators	Standardised outer loadings	Cronbach's alpha	Rho (ρ_A)	CR	AVE
Business digitalisation	DIG1	0.803	0.881	0.932	0.906	0.617
	DIG2	0.713				
	DIG3	0.861				
	DIG4	0.879				
	DIG5	0.775				
Economic sustainability	ECON1	0.886	0.757	0.761	0.891	0.804
	ECON2	0.903				
Environmental sustainability	ENV	1.000	n/a	n/a	n/a	n/a

Source: Authors' own elaboration based on PLS results.

TABLE 4 Discriminant validity (Heterotrait-monotrait [HTMT] ratio—Matrix).

Constructs	Business digitalisation	Economic sustainability
Business digitalisation		
Economic sustainability	0.173	
Environmental sustainability	0.205	0.310

Source: Authors' own elaboration based on PLS results.

4.2 | Evaluation of the structural model

We performed a two-tailed bootstrapping procedure with 10,000 subsamples to determine the statistical significance of the path coefficients. We also calculated the VIF to determine whether collinearity issues existed in the proposed model. To avoid substantial collinearity problems, Hair et al. (2022) suggested VIF values below 5. In our model, the highest value was 3.939, indicating that collinearity is not a serious concern.

Using bootstrapping, we evaluated the statistical significance of the hypothesised relationships among the constructs (Table 5), using *p*-values to assess significance levels. We also examined the coefficient of determination (R^2) to assess the explanatory power of the structural model. The R^2 analysis results indicate that the overall model accounted for 7% of the variance in environmental sustainability and 31% of the variance in economic sustainability.

According to the PLS-SEM results, the direct relationship between business digitalisation and the economic sustainability of a firm was not statistically significant; therefore, H1 is not supported. Conversely, business digitalisation was found to be positively associated with environmental sustainability (β =.45, p < .030), thus supporting H2. Similarly, we found that environmental sustainability is associated with economic sustainability, and the relationship between both variables is positive (β =.70, p < .000); therefore, H3 is supported.

Another key result of the hypotheses testing was that environmental sustainability positively mediates the relationship between business digitalisation and the economic sustainability of a company, thus supporting H4 (β =.31, p < .043). This finding indicates a full mediation model. While the direct effect is not significant (H1), the indirect effect is, implying that the overall effect of business digitalisation on the economic sustainability of a company is explained by environmental sustainability.

Regarding the effect of company size on the relationship between business digitalisation and economic sustainability (H5a), we found a positive and statistically significant association (β =0.31, p < .014). However, since the direct relationship between business digitalisation and economic sustainability was not found to be statistically significant, we avoid making inferences in this regard.

In the case of the relationship between business digitalisation and environmental sustainability, no statistically significant effect of company size was found (H5b), meaning that firm size does not influence the positive relationship between business digitalisation and environmental sustainability. However, we found that company size has a significant and negative moderating effect on the relationship between environmental sustainability and economic sustainability (β = −.63, p < .000), suggesting that this relationship is weaker or less favourable for microenterprises than for other companies. Therefore, H5c is supported.

5 | DISCUSSION

5.1 | Theoretical contributions

This study examines the direct relationship between business digitalisation and economic sustainability, while also investigating the potential mediating role of environmental sustainability. Additionally, this study investigates whether company size moderates these relationships, with a specific focus on whether microenterprises exhibit distinct patterns from larger companies.

This study makes two important contributions to the research on the intricate relationship between digitalisation, environmental sustainability, and economic sustainability. First, it challenges the hypothesised relationships by revealing a lack of significant association between business digitalisation and enterprises' economic sustainability. This suggests that increased digitalisation does not

TABLE 5 Results of the estimation of the structural model.

Structural paths	Original sample (β)	*t*-Values	Inference
H1: Business digitalisation- > Economic sustainability	−.30	1.51	Not supported
H2: Business digitalisation - > Environmental sustainability	.45**	2.18	Supported
H3: Environmental sustainability - > Economic sustainability	.70*	4.90	Supported
H4: Business digitalisation - > Environmental sustainability - > Economic sustainability	.31**	2.03	Supported
H5a: Size x Business digitalisation - > Economic sustainability	.58**	2.46	Supported
H5b: Size x Business digitalisation - > Environmental sustainability	−.34	1.34	Not supported
H5c: Size x Environmental sustainability - > Economic sustainability	−.63*	3.81	Supported

Source: Authors' own elaboration based on PLS-SEM analysis.
*$p < .01$; **$p < .05$.

necessarily lead to immediate or direct improvements in a company's economic outcomes, contradicting the prevailing views of previous studies (Bellakhal & Mouelhi, 2023; Martínez-Caro et al., 2020; Truant et al., 2021).

Nevertheless, consistent with our findings, only a few other studies have reported similar results. For example, research by Tsou and Chen (2021) conducted within Taiwanese financial companies also found no direct relationship between digital technology usage and the firm's financial and market performance. The authors suggested that factors such as digital transformation strategies and organisational innovation may influence this relationship.

Although our findings do not show a direct relationship between the level of digitalisation and greater economic performance, our study demonstrates that companies' efforts to digitalise their products, services, and processes positively impact their environmental sustainability. This finding aligns with Issah et al. (2024), suggesting that digitalisation acts as a catalyst for environmental sustainability and should be incorporated into firm-level strategies. Additionally, our results are consistent with Haq and Huo's (2023) study, which focused on small and medium enterprises (SMEs) in Pakistan and found that digitalisation can be a major driver in enhancing firms' environmental performance.

However, we not only demonstrated a positive association between digitalisation and a company's environmental sustainability but also found that this relationship may be mediated by environmental sustainability. One potential explanation for this outcome could be that the ability of digitalisation to generate a competitive advantage for firms depends on the extent to which it enhances environmental sustainability (Bendig et al., 2023). These findings are consistent with those of Broccardo et al. (2023), who found that within the context of Italian SMEs, digitalisation can positively affect companies' sustainability, which in turn contributes to improved profitability.

Our results are consistent with Nasiri, Saunila, and Ukko (2022), who concluded that companies must have the capability to comprehend and evaluate their current degree of digital orientation, intensity, and maturity to inform strategic decisions for financial success. Based on the RBV, this study advocates a strategic approach in which companies that leverage digitalisation to enhance environmental sustainability can indirectly contribute to their economic sustainability.

The second contribution of this study lies in examining the moderating role of business size. Our findings indicate that organisational context matters in the intricate relationship between digitalisation and the environmental and economic sustainability of the enterprises analysed. Specifically, our analysis revealed the negative moderating effect of business size on the relationship between environmental and economic sustainability. Although high levels of environmental sustainability generally lead to better economic outcomes, this relationship is much weaker for microenterprises compared to larger companies.

The empirical evidence from our study aligns with the findings of Roxas (2021), who analysed a sample of Vietnamese MSMEs (64.06% of which were microenterprises) and concluded that smaller firms tend to lag behind larger firms in terms of engaging in environmental management. Roxas (2021) suggested that smaller firms can address resource constraints through more intangible resources such as social capital to support their environmental management initiatives.

As evidenced in our study, microenterprises encounter various challenges in balancing the environmental aspects of sustainable development with economic sustainability. For instance, Jibril et al. (2024) explained that microenterprises face persistent constraints due to owners' perceptions that pursuing sustainability is expensive, leading firms to experience trade-offs between the social benefits and costs associated with a more sustainable business.

Moreover, the transition towards sustainability may be more challenging for established microbusinesses as they possess more limited technical, cognitive, and managerial resources than larger firms. This limitation contributes to heightened uncertainty regarding returns on sustainability investments and potential myopia concerning future market trends (Jibril et al., 2024).

In general, this study contributes to the intersection of information technology and strategic management literature. It demonstrates that digital capabilities optimise business processes, creating value for the firms (Eller et al., 2020). Additionally, a strategic orientation aligned with environmental and sustainability issues can translate into a competitive advantage for firms (Bendig et al., 2023). These findings are particularly relevant in the context of small businesses, which are often characterised by resource and capacity constraints.

5.2 | Managerial implications

Our results have important implications for small business managers and policymakers. The transition towards environmentally sustainable practices has been found to be more complex for small companies than for larger ones due to their limited financial resources and strong dependence on economic performance indicators to grow and survive (Karaeva et al., 2023). Thus, although economic benefits should not be the only motivation to improve their environmental practices, MSMEs must recognise the economic benefits of embracing environmental sustainability. If companies do not realise the business potential of environmental sustainability, their owners will lack incentives to prioritise environmental practices in their core business strategies.

In small business settings, many efforts have been made to emphasise the commercial benefits of environmental sustainability. However, studies have shown that owners often perceive environmental sustainability as difficult and expensive to implement (Revell & Blackburn, 2007), leading to a high level of scepticism among small business owners and managers regarding its business benefits (Revell, 2010).

Previous research suggests that for smaller businesses to benefit economically from sustainable management, owners and entrepreneurs must strategically rethink their approach to sustainability (Cantele & Zardini, 2018). This involves considering not only a win-win relationship in economic terms but also the benefits they can achieve in terms of business reputation and meeting customer expectations (Cantele & Zardini, 2018).

5.3 | Societal implications

Companies are expected to increase their concern about the natural environment and drastically reduce the environmental impacts derived from their operations (Lucato et al., 2017), reshaping the way business is conducted. We consider that the focus on microenterprises is extremely relevant given that these businesses hold significant potential to advance twin transitions in both the digital and environmental domains. Supporting these firms in their journey towards sustainability by encouraging the adoption of innovative green solutions has the potential to yield significant global environmental benefits (Pronti et al., 2024).

Given that our findings suggest a diminished capacity of microenterprises to convert their environmental efforts into improved economic outcomes, there is a critical need for tailored support mechanisms specifically designed to address the distinct challenges faced by these small entities. Such support can take the form of grants, subsidies, or tax incentives designed to facilitate the adoption of sustainable environmental practices. Providing technical assistance and advisory services is vital to microenterprises. Policymakers should also foster partnerships and collaborative innovation between microenterprises and larger companies to enable the mutual exchange of knowledge and resources that can drive sustainable growth.

6 | CONCLUSION

One of the main conclusions drawn from this study is that digitalising a business might not directly lead to improved economic sustainability. However, when a company focuses on improving its environmental sustainability, the positive effects of digitalisation on economic sustainability become more apparent. Given the owner-manager-entrepreneur centrism in microenterprises, future research should examine how individual owner characteristics interact with company-level factors. This approach deepens our understanding of the relationship between digitalisation and the environmental and economic sustainability of small companies.

Finally, several important limitations of this study should be considered. First, the sample size was relatively small. However, we ensured that the minimum sample size necessary to perform PLS-SEM analysis was met. We also found that 62% of our companies are microenterprises. Collecting data on microenterprises is helpful for advancing research in this context, given the current absence of internationally comparable empirical data on the digitalisation efforts undertaken by microenterprises. Despite the fact that microenterprises constitute approximately 90% of the business population within OECD countries, there is a notable deficiency in available information concerning their digitalisation endeavours (OECD, 2021b).

Another potential limitation of this study is social desirability bias. As proposed by Heras-Saizarbitoria et al. (2020), environmental sustainability measures primarily based on managers' perceptions or opinions may be influenced by social desirability or self-reporting bias. However, in line with Wang et al. (2023), we implemented several strategies to mitigate the influence of social desirability bias and encouraged participants to provide honest perspectives. These strategies included guaranteeing anonymity and confidentiality for participants and requesting answers from their firms' perspectives rather than expressing personal opinions (Wang et al., 2023).

Considering that this study provides only a snapshot in time, longitudinal studies are needed to address endogeneity concerns in the proposed research model. Endogeneity can compromise key conditions for claiming causality (Zhang et al., 2022). Therefore, the relationships suggested should be interpreted more as robust correlations rather than causal links. However, we managed the observed heterogeneity through moderation analysis, which, as outlined by Guenther et al. (2023), can help alleviate endogeneity issues. Additionally, we incorporated theoretically relevant control variables into our research model to reduce omitted variable bias (Proksch et al., 2021).

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CONFLICT OF INTEREST STATEMENT

The authors declare no conflicts of interest.

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REFERENCES

Amankwah-Amoah, J., & Syllias, J. (2020). Can adopting ambitious environmental sustainability initiatives lead to business failures? An analytical framework. *Business Strategy and the Environment*, *29*(1), 240–249. https://doi.org/10.1002/bse.2361

Ardito, L., Raby, S., Albino, V., & Bertoldi, B. (2021). The duality of digital and environmental orientations in the context of SMEs: Implications for innovation performance. *Journal of Business Research*, *123*, 44–56. https://doi.org/10.1016/j.jbusres.2020.09.022

Armstrong, J. S., & Overton, T. S. (1977). Estimating nonresponse bias in mail surveys. *Journal of Marketing Research*, *14*(3), 396. https://doi.org/10.2307/3150783

Barney, J. B. (1991). Firm resources and sustained competitive advantage. *Journal of Management*, *17*(1), 99–120. https://doi.org/10.1016/j.jaci.2012.05.050

Bellakhal, R., & Mouelhi, R. (2023). Digitalisation and firm performance: Evidence from Tunisian SMEs. *International Journal of Productivity and Quality Management*, *39*(1), 42–65.

Bendig, D., Schulz, C., Theis, L., & Raff, S. (2023). Digital orientation and environmental performance in times of technological change. *Technological Forecasting and Social Change*, *188*, 122272. https://doi.org/10.1016/j.techfore.2022.122272

Benitez, J., Henseler, J., Castillo, A., & Schuberth, F. (2020). How to perform and report an impactful analysis using partial least squares: Guidelines for confirmatory and explanatory IS research. *Information and Management*, *57*(2), 103168. https://doi.org/10.1016/j.im.2019.05.003

Berlina, A., & Randall, L. (2019). Governing the digital transition in the Nordic regions. In *Nordregio Report* (Vol. 4). https://doi.org/10.30689/PB2019:8.2001-3876

Björkdahl, J. (2020). Strategies for digitalization in manufacturing firms. *California Management Review*, *62*(4), 17–36. https://doi.org/10.1177/0008125620920349

Boakye, D. J., TIngbani, I., Ahinful, G., Damoah, I., & Tauringana, V. (2020). Sustainable environmental practices and financial performance: Evidence from listed small and medium-sized enterprise in the United Kingdom. *Business Strategy and the Environment*, *29*(6), 2583–2602. https://doi.org/10.1002/bse.2522

Brenner, B., & Hartl, B. (2021). The perceived relationship between digitalization and ecological, economic, and social sustainability. *Journal of Cleaner Production*, *315*, 128128. https://doi.org/10.1016/j.jclepro.2021.128128

Broccardo, L., Truant, E., & Dana, L. P. (2023). The interlink between digitalization, sustainability, and performance: An Italian context. *Journal of Business Research*, *158*, 113621. https://doi.org/10.1016/j.jbusres.2022.113621

Busch, T., Barnett, M. L., Burritt, R. L., Cashore, B. W., Freeman, R. E., Henriques, I., Husted, B. W., Panwar, R., Pinkse, J., Schaltegger, S., & York, J. (2023). Moving beyond "the" business case: How to make corporate sustainability work. *Business Strategy and the Environment*, *33*(2), 776–787. https://doi.org/10.1002/bse.3514

Caglar, A. E., Daştan, M., Bulut, E., & Marangoz, C. (2024). Evaluating a pathway for environmental sustainability: The role of competitive industrial performance and renewable energy consumption in European countries. *Sustainable Development*, *32*(3), 1811–1824. https://doi.org/10.1002/sd.2755

Calış Duman, M., & Akdemir, B. (2021). A study to determine the effects of industry 4.0 technology components on organizational performance. *Technological Forecasting and Social Change*, *167*, 120615. https://doi.org/10.1016/j.techfore.2021.120615

Cantele, S., & Zardini, A. (2018). Is sustainability a competitive advantage for small businesses? An empirical analysis of possible mediators in the sustainability–financial performance relationship. *Journal of Cleaner Production*, *182*, 166–176. https://doi.org/10.1016/j.jclepro.2018.02.016

Cunningham, J. A., Damij, N., Modic, D., & Olan, F. (2023). MSME technology adoption, entrepreneurial mindset and value creation: A configurational approach. *Journal of Technology Transfer*, *48*(5), 1574–1598. https://doi.org/10.1007/s10961-023-10022-0

de Villiers, C., Naiker, V., & van Staden, C. J. (2011). The effect of board characteristics on firm environmental performance. *Journal of Management*, *37*(6), 1636–1663. https://doi.org/10.1177/0149206311411506

del Giudice, M., Khan, Z., de Silva, M., Scuotto, V., Caputo, F., & Carayannis, E. (2017). The microlevel actions undertaken by owner-managers in improving the sustainability practices of cultural and creative small and medium enterprises: A United Kingdom–Italy comparison. *Journal of Organizational Behavior*, *38*(9), 1396–1414. https://doi.org/10.1002/job.2237

Denicolai, S., Zucchella, A., & Magnani, G. (2021). Internationalization, digitalization, and sustainability: Are SMEs ready? A survey on synergies and substituting effects among growth paths. *Technological Forecasting and Social Change*, *166*, 120650. https://doi.org/10.1016/j.techfore.2021.120650

di Bella, L., Katsinis, A., Lagüera-González, J., Odenthal, L., Hell, M., & Lozar, B. (2023). Annual report on European SMEs 2022/2023. In *Publications office of the European Union*. Luxemburg. https://doi.org/10.2760/028705

Eller, R., Alford, P., Kallmünzer, A., & Peters, M. (2020). Antecedents, consequences, and challenges of small and medium-sized enterprise digitalization. *Journal of Business Research*, *112*, 119–127. https://doi.org/10.1016/j.jbusres.2020.03.004

European Commission. (2022). *Digital economy and society index – DESI*. Retrieved from https://digital-strategy.ec.europa.eu/en/library/digital-economy-and-society-index-desi-2021

Gaglio, C., Kraemer-Mbula, E., & Lorenz, E. (2022). The effects of digital transformation on innovation and productivity: Firm-level evidence of South African manufacturing micro and small enterprises. *Technological Forecasting and Social Change*, *182*, 121785. https://doi.org/10.1016/j.techfore.2022.121785

Garcia-Pereyra, F., Matute, J., & Argilés-Bosch, J. M. (2023). The relevance of nurses' self-concept in the social exchange process: A serial mediation model. *Management Decision*, *61*(13), 172–191. https://doi.org/10.1108/MD-07-2022-1015

Gherhes, C., Williams, N., Vorley, T., & Vasconcelos, A. C. (2016). Distinguishing micro-businesses from SMEs: A systematic review of growth constraints. *Journal of Small Business and Enterprise Development*, *23*(4), 939–963. https://doi.org/10.1108/JSBED-05-2016-0075

Guenther, P., Guenther, M., Ringle, C. M., Zaefarian, G., & Cartwright, S. (2023). Improving PLS-SEM use for business marketing research. *Industrial Marketing Management*, *111*, 127–142. https://doi.org/10.1016/j.indmarman.2023.03.010

Guo, Q., Geng, C., & Yao, N. (2023). How does green digitalization affect environmental innovation? The moderating role of institutional forces. *Business Strategy and the Environment*, *32*(6), 3088–3105. https://doi.org/10.1002/bse.3288

Hair, J. F., Hult, G. T. M., Ringle, C. M., & Sarstedt, M. (2022). *A primer on partial least squares structural equation modeling (PLS-SEM)*. SAGE Publications Ltd.

Hair, J. F., Risher, J. J., Sarstedt, M., & Ringle, C. M. (2019). When to use and how to report the results of PLS-SEM. *European Business Review*, *31*(1), 2–24. https://doi.org/10.1108/EBR-11-2018-0203

Haq, I. U., & Huo, C. (2023). Digital strategy and environmental performance: The mediating role of digitalization in SMEs. *Digital Economy and Sustainable Development*, *1*(1), 1–13. https://doi.org/10.1007/s44265-023-00010-5

Hassan, S. S., Meisner, K., Krause, K., Bzhalava, L., & Moog, P. (2023). Is digitalization a source of innovation? Exploring the role of digital diffusion in SME innovation performance. *Small Business Economics*, *62*, 1469–1491. https://doi.org/10.1007/s11187-023-00826-7

Henseler, J., Hubona, G., & Ray, P. A. (2016). Using PLS path modeling in new technology research: Updated guidelines. *Industrial Management and Data Systems*, *116*(1), 2–20. https://doi.org/10.1108/IMDS-09-2015-0382

Heras-Saizarbitoria, I., Boiral, O., & Díaz de Junguitu, A. (2020). Environmental management certification and environmental performance: Greening or greenwashing? *Business Strategy and the Environment*, *29*(6), 2829–2841. https://doi.org/10.1002/bse.2546

Hull, C. E., Hung, Y. T. C., Hair, N., Perotti, V., & Demartino, R. (2007). Taking advantage of digital opportunities: A typology of digital entrepreneurship. *International Journal of Networking and Virtual Organisations*, *4*(3), 290–303. https://doi.org/10.1504/IJNVO.2007.015166

Issah, W. B., Ferdous, L. T., Bhuiyan, F., & Sharif, T. (2024). Digitalisation and environmental management activities: The effects of family ownership. *Business Strategy and the Environment*, 1–24. https://doi.org/10.1002/bse.3706

Jibril, H., Kesidou, E., & Roper, S. (2024). Do digital technologies enable firms that prioritize sustainability goals to innovate? Empirical evidence from established UK micro-businesses. *British Journal of Management*. https://doi.org/10.1111/1467-8551.12821

Jones, P., Simmons, G., Packham, G., Beynon-Davies, P., & Pickernell, D. (2014). An exploration of the attitudes and strategic responses of sole-proprietor micro-enterprises in adopting information and communication technology. *International Small Business Journal*, *32*(3), 285–306. https://doi.org/10.1177/0266242612461802

Karaeva, A., Ionescu, G., Cioca, L. I., Tolkou, A., Katsoyiannis, I., & Kyzas, G. (2023). Environmental sustainability for traditional energy small and medium enterprises. *Environmental Science and Pollution Research*, *30*(16), 47822–47831. https://doi.org/10.1007/s11356-023-25718-x

Kock, F., Berbekova, A., & Assaf, A. G. (2021). Understanding and managing the threat of common method bias: Detection, prevention and control. *Tourism Management*, *86*(April), 104330. https://doi.org/10.1016/j.tourman.2021.104330

Kock, N. (2015). Common method bias in PLS-SEM: A full collinearity assessment approach. *International Journal of E-Collaboration*, *11*(4), 1–10. https://doi.org/10.4018/ijec.2015100101

Lee, M. J., & Roh, T. (2023). Unpacking the sustainable performance in the business ecosystem: Coopetition strategy, open innovation, and digitalization capability. *Journal of Cleaner Production*, *412*, 137433. https://doi.org/10.1016/j.jclepro.2023.137433

Li, L., Zhou, H., Yang, S., & Teo, T. S. H. (2023). Leveraging digitalization for sustainability: An affordance perspective. *Sustainable Production and Consumption*, *35*, 624–632. https://doi.org/10.1016/j.spc.2022.12.011

Li, Y., Dai, J., & Cui, L. (2020). The impact of digital technologies on economic and environmental performance in the context of industry 4.0: A moderated mediation model. *International Journal of Production Economics*, *229*, 107777. https://doi.org/10.1016/j.ijpe.2020.107777

Linnenluecke, M. K., & Griffiths, A. (2013). Firms and sustainability: Mapping the intellectual origins and structure of the corporate sustainability field. *Global Environmental Change*, *23*(1), 382–391. https://doi.org/10.1016/j.gloenvcha.2012.07.007

Lucato, W. C., Costa, E. M., & de Oliveira Neto, G. C. (2017). The environmental performance of SMEs in the Brazilian textile industry and the relationship with their financial performance. *Journal of Environmental Management*, *203*, 550–556. https://doi.org/10.1016/j.jenvman.2017.06.028

Manika, D., Wells, V. K., Gregory-Smith, D., & Gentry, M. (2015). The impact of individual attitudinal and organisational variables on workplace environmentally friendly behaviours. *Journal of Business Ethics*, *126*(4), 663–684. https://doi.org/10.1007/s10551-013-1978-6

Martínez-Caro, E., Cegarra-Navarro, J. G., & Alfonso-Ruiz, F. J. (2020). Digital technologies and firm performance: The role of digital organisational culture. *Technological Forecasting and Social Change*, *154*(June), 119962. https://doi.org/10.1016/j.techfore.2020.119962

Memon, M. A., Thurasamy, R., Cheah, J. H., Ting, H., Chuah, F., & Cham, T. H. (2023). Addressing common method bias, operationalization, sampling, and data collection issues in quantitative research: Review and recommendations. *Journal of Applied Structural Equation Modeling*, *7*(2), 1–14. https://doi.org/10.47263/JASEM.7(2)01

Nafizah, U. Y., Roper, S., & Mole, K. (2023). Estimating the innovation benefits of first-mover and second-mover strategies when micro-businesses adopt artificial intelligence and machine learning. *Small Business Economics*, *62*(1), 411–434. https://doi.org/10.1007/s11187-023-00779-x

Nasiri, M., Saunila, M., Rantala, T., & Ukko, J. (2022). Sustainable innovation among small businesses: The role of digital orientation, the external environment, and company characteristics. *Sustainable Development*, *30*(4), 703–712. https://doi.org/10.1002/sd.2267

Nasiri, M., Saunila, M., & Ukko, J. (2022). Digital orientation, digital maturity, and digital intensity: Determinants of financial success in digital transformation settings. *International Journal of Operations and Production Management*, *42*(13), 274–298. https://doi.org/10.1108/IJOPM-09-2021-0616

Nguyen, N. P., & Adomako, S. (2022). International orientation and environmental performance in Vietnamese exporting small- and medium-sized enterprises. *Business Strategy and the Environment*, *31*(5), 2424–2436. https://doi.org/10.1002/bse.3035

Nitzl, C. (2016). The use of partial least squares structural equation modelling (PLS-SEM) in management accounting research: Directions for future theory development. *Journal of Accounting Literature*, *37*, 19–35. https://doi.org/10.1016/j.acclit.2016.09.003

OECD. (2021a). *OECD environmental performance reviews: Finland 2021*. OECD Publishing. https://doi.org/10.1787/D73547B7-EN

OECD. (2021b). *The digital transformation of SMEs, OECD studies on SMEs and entrepreneurship*. OECD Publishing, Ed. https://doi.org/10.2991/aebmr.k.220603.050

OECD. (2022). Financing SMEs for sustainability: Drivers, constraints and policies. In *OECD SME and entrepreneurship papers, (35), No. 35*. OECD Publishing.

OECD. (2023a). Enterprises by business size (indicator). https://doi.org/10.1787/31d5eeaf-en

OECD. (2023b). *Managing shocks and transitions*. Retrieved from. https://www.oecd.org/cfe/smes/key-issues-paper-oecd-sme-and-entrepreneurship-ministerial-meeting-2023.pdf

Podsakoff, P. M., MacKenzie, S. B., Lee, J. Y., & Podsakoff, N. P. (2003). Common method biases in behavioral research: A critical review of the literature and recommended remedies. *Journal of Applied Psychology*, *88*(5), 879–903. https://doi.org/10.1037/0021-9010.88.5.879

Podsakoff, P. M., MacKenzie, S. B., & Podsakoff, N. P. (2012). Sources of method bias in social science research and recommendations on how to control it. *Annual Review of Psychology*, *63*, 539–569. https://doi.org/10.1146/annurev-psych-120710-100452

Prajogo, D. I. (2006). The relationship between innovation and business performance—A comparative study between manufacturing and service firms. *Knowledge and Process Management*, *13*(3), 218–225. https://doi.org/10.1002/kpm.259

Proksch, D., Rosin, A. F., Stubner, S., & Pinkwart, A. (2021). The influence of a digital strategy on the digitalization of new ventures: The mediating effect of digital capabilities and a digital culture. *Journal of Small*

Business Management, *62*(1), 1–29. https://doi.org/10.1080/00472778.2021.1883036

Prömpeler, J., Veltrop, D., Stoker, J., & Rink, F. (2023). Striving for sustainable development at the top: Exploring the interplay of director and CEO values on environmental sustainability focus. *Business Strategy and the Environment*, *32*(7), 5068–5082. https://doi.org/10.1002/bse.3408

Pronti, A., Zecca, E., & Antonioli, D. (2024). Micro is beautiful. Adoption of eco-innovations in micro-firms. *Business Strategy and the Environment*, *33*(2), 1341–1368. https://doi.org/10.1002/bse.3553

Radicic, D., & Petković, S. (2023). Impact of digitalization on technological innovations in small and medium-sized enterprises (SMEs). *Technological Forecasting and Social Change*, *191*, 122474. https://doi.org/10.1016/j.techfore.2023.122474

Rastrollo-Horrillo, M. A. (2021). Dismantling the myths about managerial (in)capabilities in micro-firms. SEAM intervention-research to develop management practices. *Scandinavian Journal of Management*, *37*(3), 101158. https://doi.org/10.1016/j.scaman.2021.101158

Raza, Z., & Woxenius, J. (2023). Customer-driven sustainable business practices and their relationships with environmental and business performance–Insights from the European shipping industry. *Business Strategy and the Environment*, *32*(8), 6138–6153. https://doi.org/10.2139/ssrn.4014034

Rehman, S. U., Bresciani, S., Yahiaoui, D., & Giacosa, E. (2022). Environmental sustainability orientation and corporate social responsibility influence on environmental performance of small and medium enterprises: The mediating effect of green capability. *Corporate Social Responsibility and Environmental Management*, *29*(6), 1954–1967. https://doi.org/10.1002/csr.2293

Revell, A. (2010). Small businesses and the environment: Turning over a new leaf? *Business Strategy and the Environment*, *19*, 273–288. https://doi.org/10.1108/sd.2011.05627aad.004

Revell, A., & Blackburn, R. (2007). The business case for sustainability? An examination of small firms in the UK's construction and restaurant sectors. *Business Strategy and the Environment*, *16*(6), 404–420. https://doi.org/10.1002/bse.499/abstract

Rintala, O., Laari, S., Solakivi, T., Töyli, J., Nikulainen, R., & Ojala, L. (2022). Revisiting the relationship between environmental and financial performance: The moderating role of ambidexterity in logistics. *International Journal of Production Economics*, *248*, 108479. https://doi.org/10.1016/j.ijpe.2022.108479

Roxas, B. (2021). Environmental sustainability engagement of firms: The roles of social capital, resources, and managerial entrepreneurial orientation of small and medium enterprises in Vietnam. *Business Strategy and the Environment*, *30*(4), 2194–2208. https://doi.org/10.1002/bse.2743

Saget, C., Karimova, T., & Luu, T. (2022). Greening enterprises. Transforming processes and workplaces. Retrieved from https://www.ilo.org/global/publications/books/WCMS_861384/lang–en/index.htm

Saunila, M., Nasiri, M., Ukko, J., & Rantala, T. (2019). Smart technologies and corporate sustainability: The mediation effect of corporate sustainability strategy. *Computers in Industry*, *108*, 178–185. https://doi.org/10.1016/j.compind.2019.03.003

Simba, A., & Thai, M. T. T. (2019). Advancing entrepreneurial leadership as a practice in MSME management and development. *Journal of Small Business Management*, *57*(S2), 397–416. https://doi.org/10.1111/jsbm.12481

Sipola, J., Saunila, M., & Ukko, J. (2023). Adopting artificial intelligence in sustainable business. *Journal of Cleaner Production*, *426*, 139197. https://doi.org/10.1016/j.jclepro.2023.139197

Statista. (2021). IT services and digitalization of business in Finland—statistics & facts. Retrieved from Digital & Trends website: https://www-statista-com.ezproxy.cc.lut.fi/topics/7860/it-services-and-digitalization-of-business-in-finland/#topicOverview

Statistics Finland. (2023). Enterprises by size class in personnel 2021. Retrieved October 24, 2023, from Structural business and financial statement statistics website: https://www.stat.fi/en/statistics/yrti

The Regional Council of Päijät-Häme. (2024). The region of Päijät—Häme. Retrieved from https://paijat-hame.fi/en/paijat-hame-region/

Truant, E., Broccardo, L., & Dana, L. P. (2021). Digitalisation boosts company performance: An overview of Italian listed companies. *Technological Forecasting and Social Change*, *173*, 121173. https://doi.org/10.1016/j.techfore.2021.121173

Tsou, H. T., & Chen, J. S. (2021). How does digital technology usage benefit firm performance? Digital transformation strategy and organisational innovation as mediators. *Technology Analysis and Strategic Management*, *35*(9), 1–14. https://doi.org/10.1080/09537325.2021.1991575

Ukko, J., Nasiri, M., Saunila, M., & Rantala, T. (2019). Sustainability strategy as a moderator in the relationship between digital business strategy and financial performance. *Journal of Cleaner Production*, *236*, 117626. https://doi.org/10.1016/j.jclepro.2019.117626

United Nations. (2023). Micro-, small and medium-sized enterprises day, 27 June. Retrieved October 23, 2023, from https://www.un.org/en/observances/micro-small-medium-businesses-day

Vanhamäki, S., Virtanen, M., Luste, S., & Manskinen, K. (2020). Transition towards a circular economy at a regional level: A case study on closing biological loops. *Resources, Conservation and Recycling*, *156*, 104716. https://doi.org/10.1016/j.resconrec.2020.104716

Wang, K., Zhang, L., Lei, Z., & Huang, X. (2023). Investigating the impact of digital orientation on economic and environmental performance based on a strategy-structure-performance framework. *International Journal of Logistics Research and Applications*, 1–18. https://doi.org/10.1080/13675567.2023.2215167

Wu, H., Hu, S., & Hu, S. (2023). How digitalization works in promoting corporate sustainable development performance? The mediating role of green technology innovation. *Environmental Science and Pollution Research*, *30*(8), 22013–22023. https://doi.org/10.1007/s11356-022-23762-7

Yang, X., Xu, Y., Razzaq, A., Wu, D., Cao, J., & Ran, Q. (2024). Roadmap to achieving sustainable development: Does digital economy matter in industrial green transformation? *Sustainable Development*, *32*(3), 2583–2599. https://doi.org/10.1002/sd.2781

Yang, Y., Yang, X., Xiao, Z., & Liu, Z. (2023). Digitalization and environmental performance: An empirical analysis of Chinese textile and apparel industry. *Journal of Cleaner Production*, *382*, 135338. https://doi.org/10.1016/j.jclepro.2022.135338

Yu, F., Jiang, D., Zhang, Y., & Du, H. (2023). Enterprise digitalisation and financial performance: The moderating role of dynamic capability. *Technology Analysis and Strategic Management*, *35*(6), 704–720. https://doi.org/10.1080/09537325.2021.1980211

Zhang, X., Fang, H., Dou, J., & Chrisman, J. J. (2022). Endogeneity issues in family business research: Current status and future recommendations. *Family Business Review*, *35*(1), 91–116.

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